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Special Issue

DISEASES OF POULTRY

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A Special Issue on Poultry Practice

The growing interest of veterinarians in poultry diseases has led to this special issue of VETERINARY MEDICINE. It contains papers from many of the outstanding investigators and teachers of the subject and it is hoped will prove materially helpful to those interested in advancing the poultry industry. An attempt has been made to introduce a wide variety of subject matter, and to present it in such a manner that it will be of practical value to veterinarians engaged in practice who have insufficient time to read all the scientific journals that deal with these subjects. The control of animal disease is the province of the veterinarian. He can fulfill his obligation to the community only when he becomes entirely familiar with the problems confronting him.

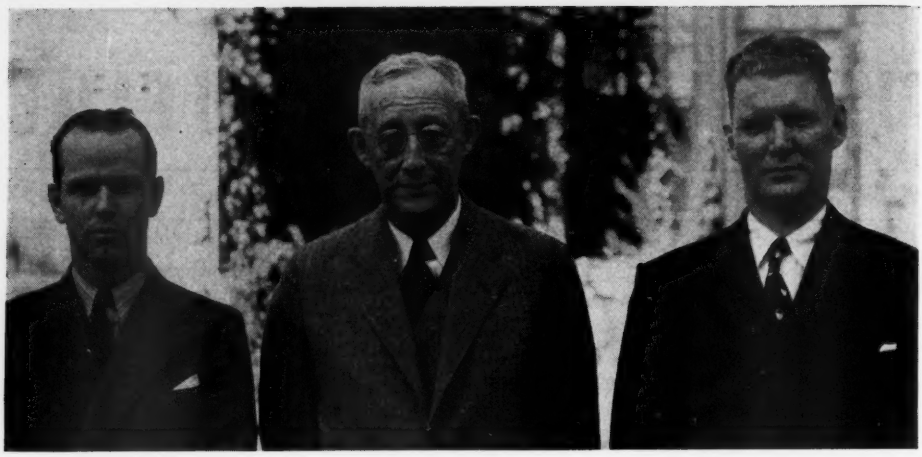
In the past the veterinarian has not taken sufficient interest in the important field of poultry husbandry. There are several reasons for this but some of them can be corrected in the near future if the members of the profession will take time to acquaint themselves with the problems of the poultryman.

The poultry industry is now a "billion-dollar" business and is certainly worthy of the attention necessary to keep it in a healthy condition. It is quite evident that it is not receiving its proper share of veterinary service when the annual mortality rates run from 20% to 50%, as at present.

The control of disease among poultry must be considered on a flock basis. The low unit value of the individual bird does not permit expensive types of treatment and the veterinarian cannot expect large financial return from this branch of his practice. He can, however, render his community valuable service and gain the confidence of his patrons by conducting an effective poultry improvement program; on the whole materially increase and at the same time prevent intrusions of the untrained into the field of animal disease control; an intrusion that may extend readily to other branches of the live stock industry.

At the 7th World's Poultry Congress in Cleveland last summer, a definite effort was made by the management of the Congress to (1) interest veterinarians in serving the poultry industry as they serve other branches of animal husbandry, and (2) induce the poultry raisers to avail themselves of skilled veterinarian service in the prevention and treatment of disease to a far greater extent than heretofore.

Both efforts were measurably successful.



Marvin J. Twiehaus | Leland D. Bushnell | Edwin J. Frick

This special poultry issue was prepared by Dr. Leland D. Bushnell in collaboration with Dr. Edwin J. Frick and Dr. Marvin J. Twiehaus, all of Kansas State College. Doctor Bushnell, B.S. Michigan State College 1905, M.S. University of Kansas 1915, Ph.D. Harvard University 1921, is head of the Department of Bacteriology. He has written some 60 bulletins and articles on bacteriology and poultry diseases; is a member of Alpha Zeta, Phi Kappa Phi, Gamma Sigma Delta, Sigma Xi, the Society of American Bacteriologists, American Association for Advancement of Science, Kansas Medical Laboratory Association, Missouri Valley branch society American Bacteriologists, etc. Doctor Bushnell occupies a unique place in Veterinary Medicine as the fountain head and inspirational source in the early professional development of such men as Drs. F. R. Beaudette, E. H. Borger, James J. Black, Wm. R. Hinshaw, John W. Patton, John West, J. E. Knappenberger, D. E. Davis, and C. A. Brandly, all renowned in the field of poultry pathology.

Doctor Twiehaus, junior collaborator in this issue of VETERINARY MEDICINE, is associated in his daily work with Doctor Bushnell.

Doctor Frick is Professor of Medicine and Head of the Dept. of Surgery and Medicine in the Division of Veterinary Medicine, Kansas State College. He has edited previously two special issues of VETERINARY MEDICINE—Fur Animal Practice, the issue for December, 1936, and Feline Practice, the issue for November, 1937. Both issues have been reprinted as booklets and have proved popular and in much demand.

Space limitations make it necessary to hold over several excellent articles prepared for this issue. These articles, which will appear in early issues, include:

The Avian Embryo in Disease Study, by C. A. Brandly.

Fowl Cholera and *Fowl Typhoid,* by L. D. Bushnell.

Paratyphoid Infections, by E. Jungherr.

Pullorum Disease Control and Eradication, by H. Van Roekel.

The National Plan for Pullorum Disease Control, by H. Bunyea and P. B. Zumbro.

Trichomoniasis in Turkeys, by L. D. Bushnell and M. J. Twiehaus.

The Large Roundworm of Chickens, by J. E. Ackert.

Diseases of Game Birds, by J. E. Shillinger and D. R. Coburn.

Nematodes Transmissible to Game Birds, by E. E. Wehr.

Incubator Hygiene, by R. Graham and H. R. Hester.

Nicotine in the Control of Ascaridia Lineata, by D. E. Davis.

Practical Methods of Poultry Disease Control, by J. R. Christian and H. R. Hornbaker.

The Challenge of Poultry Mortality To the Veterinary Profession

By J. HOLMES MARTIN,
East Lansing, Michigan
Director, Regional Poultry Research Laboratory

AMERICA'S billion-dollar poultry industry became of age with the holding of the World's Poultry Congress at Cleveland, Ohio, July 28-August 7, 1939. Never before has the American public been so conscious of this tremendous resource. During the past decade the farmer, the scientist, and the businessman whose interests touched some one or another of the many ramifications of the industry, have become increasingly aware of the vital part the hen and her products play in the American economy. Figures for the 10-year period 1926-1935, which include years of both high and low prices, show a gross return to farmers, from poultry and eggs, exceeding a billion dollars a year. The average annual values for that period were approximately $570,000,000 for eggs, $400,000,000 for chickens, $49,000,000 for turkeys, and $20,000,000 for ducks, geese and other fowls.

■ The Bureau of Agricultural Economics estimates show that approximately 63,982,000 of the 420,257,000 chickens on farms January 1, 1937, died during the year. This is a mortality of 15%, exclusive of chick and young stock losses. If these adult birds be valued at a market price of 75c each, this represents an annual loss of $48,000,000 due to adult mortality. In addition to this cash loss, there is the loss of "productive units." The overhead costs of caring for the flock such as housing, depreciation, labor, etc., remain pretty much the same whether the flock contains the original number housed or the smaller number due to flock reduction. This means a greater overhead charge per hen that lives and less profit per hen, as well as a smaller total income because of mortality.

That mortality among laying hens has increased rapidly during recent years is a story too well known to need further comment. A glance at the poultry mortality situation during the past 25 to 30 years shows that many of the results of research which have been put into practice have led to considerable reduction in embryo mortality and chick mortality. The hatchability of eggs and viability of chicks have increased to levels that are highly practical while, on the other hand, the laying house mortality has increased with staggering rapidity.

■ Much valuable research by pathologists and bacteriologists has been interpreted into practice through the testing and eradication programs that have brought about a very considerable reduction of mortality from pullorum disease and tuberculosis. The knowledge of the life cycles of internal parasites and their intermediate hosts brought to us through the studies of parasitologists has led to the adoption of sanitation practices and range rotations that have greatly reduced the hazards of rearing chicks. Vaccination has in some cases, notably fowl pox and laryngotracheitis, produced an artificial immunity to carry the bird past the period of its greatest susceptibility.

Management practices, when wisely followed, aid greatly in lessening the exposure of the flock to diseases and parasites. Control of coryza and chick bronchitis depends upon segregation and the avoidance of exposure through good management, rather than upon building up resistance through breeding, vaccination, or otherwise. Sanitation is of paramount importance in good husbandry. The poultryman must be ever on the alert for the first case of any disease or upset. He must decide when the situation is serious enough to demand the attention of a veterinarian.

A veterinarian, pathologist or parasitologist who has spent much time in the study

of animal diseases can many times detect possible avenues of entrance of disease that would not be apparent to the layman. The pathologist is aware of the tremendous amount of research that has been carried out with drugs and other products known to be effective in the treatment of diseases of mammals, but still of questionable value in the treatment of poultry diseases. Except for use in the elimination of certain internal and external parasites, drugs and medicines have not proved to be of great value to the poultryman. In case of an outbreak, the procedure for further necessary sanitation practices to avoid spread should be determined immediately. In view of the progress that has been made in successfully combating certain of the principal diseases, why this increase in mortality has occurred has become a challenging question.

■ The practicing veterinarian should think of the poultry flock as an animal unit. The farmer frequently has as much or more invested in his flock of chickens as he has in a good cow or horse, hence should be as much concerned about the health of the flock as of the welfare of any of his larger animals. The practitioner could well afford to bring his clients to the view that he has a service to offer, in diagnosis coupled with recommendations as to prevention and sanitation, that is not prohibitive in cost when considered on the basis of maintenance of the flock rather than of the individual hen.

The veterinarian leaves with the farmer directions for action. Many farmers and poultrymen *talk* about hygiene and sanitation, but it still remains for them to *do* something about it, to paraphrase Mark Twain's remark about the weather. The veterinarian is in a much better position than the layman to ferret out possible avenues of entrance of an infection to the farm and show the poultryman how to proceed in checking the ravages of preventable diseases.

That the farmer is willing to part with his hard-earned money to check the losses in his poultry flock is abundantly proved by his "medicine-mindedness." It has been estimated that in excess of 10 million dollars is expended annually for poultry remedies and tonics. The task at hand is to get him to see that his expenditures on remedies of no proved therapeutic value should be shifted to investments in the services of men especially trained in coping with the problems of disease. In many cases remedies are credited with merit, simply because the farmer administered them after most of the susceptible individuals had died off and the peak of infection had passed.

The poultryman is in somewhat the relation to his flock as the county health nurse is to her clientele. He must be ever on the alert for the first symptoms of trouble and take the necessary steps to isolate, prevent spread, and correct the management practices. Just as with minor disorders the nurse handles the situation, so the poultryman must cope with the lesser troubles. When the situation appears serious and fails to yield to the simpler procedures, the trained veterinarian comes into the picture. As the poultryman and farmer come to see that the veterinarians of today are taking an increasing interest in poultry problems and have much to offer them with respect to their disease problems, they will turn to the practitioner for diagnosis and advice.

What a person *thinks* is so, *is* so, insofar as his decisions and actions are concerned. Chiefly because of "high-powered" salesmanship and advertising the mass of the farmers think that remedies and tonics will suffice in the treatment of poultry diseases. The only hope for the dissipation of this "medicine-mindedness" is through education. A few flocks in each community properly treated and cared for as prescribed by the veterinarian who is informed and trained in poultry pathology will serve to demonstrate the right way.

■ Obviously, the success of the practitioner depends in no small measure upon the advances made in poultry pathology research. Tremendous progress has been made in recent years in the control of chick diseases, particularly coccidiosis and pullorum

disease. Fowl pox, laryngotracheitis, typhoid, cholera and tuberculosis no longer need exact a heavy toll among adult birds. Analysis of the present situation emphasizes that in spite of much field and experimental observation adult mortality remains of major concern. Increased facilities and personnel are being directed toward curbing this menace to the industry, both in this country and abroad. An attack on the problem by concerted research is contemplated in Great Britain and a coöperative undertaking in this direction is under way in the U. S. Regional Poultry Research Laboratory at East Lansing, Michigan. Twenty-five states in the region comprising the north central and northeastern group are coördinating active programs to improve the viability of poultry.

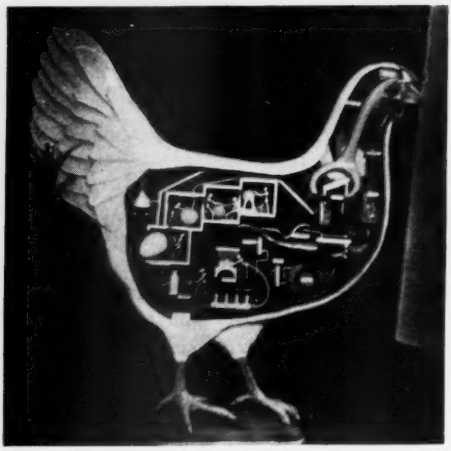
This coöperative approach to research dealing with the viability of poultry had its inception at a meeting of the directors of the northeastern experiment stations on September 12 and 13, 1935. The directors of these 12 stations passed resolutions petitioning the Secretary of Agriculture to include among the regional laboratories financed from the Bankhead-Jones funds one which would deal with the viability of poultry. Since no action had been taken on this matter by the spring of 1937, the authorities of the Ohio State University invited the representatives of the poultry industry to meet in Columbus on April 5, 1937, to discuss ways and means of attacking the poultry mortality problem. This meeting was well attended by representatives of all phases of the poultry industry, the press, and the educational and scientific fields. It was the consensus of this group that the establishment of a Regional Poultry Research Laboratory would afford the most feasible approach to the solution of the problem. Resolutions were adopted requesting the directors of the various experiment stations and the Secretary of Agriculture to take action to that end. The directors of the experiment stations of the northeastern and north central states held a conference in Washington, D. C. on November 14, 1937, and approved the establishment of a Regional Poultry Research Laboratory to coöperate with and coördinate the efforts of the 25 states concerned. A memorandum of understanding was signed by the directors of the 25 coöperating experiment stations and approved by the Secretary of Agriculture on March 25, 1938. Construction was under way by July, 1938. The laboratory building and poultry houses were completed by January, 1939, and the first experimental chicks were hatched April 3, 1939. The formal dedication of the Laboratory was held August 8, 1939, the dedicatory address being given by Dr. John R. Mohler, Chief of the B. A. I.

Brooder Houses and Other Buildings at the Regional Poultry Research Laboratory at East Lansing, Mich.

The World's Poultry Congress

By L. F. PAYNE, Manhattan, Kansas
Head, Department of Poultry Husbandry, Kansas State College

A MILLION Dollar Show for a Billion Dollar Industry—Largest Agricultural Exposition Ever Held—45 Countries and 48 States Join Hands to Honor the Hen—850,000 people see 22 Acres of Exhibits in 11 Days—222 Commercial Exhibitors Buy $135,000 Worth of Floor Space—these and many other headlines featured the Seventh World's Poultry Congress and Exposition at Cleveland, Ohio, July 28 to August 7.



The Massachusetts Exhibit, featuring this mechanical hen, attracted much attention.

No attempt is made in this article to give a complete report of the congress or review any of the numerous papers presented on the pathology and disease control program. They occupy nearly 300 pages in the published proceedings of the congress. Veterinary practitioners and students of veterinary medicine interested in poultry disease work will find these articles very illuminating. The purpose of this article is merely to give a cross sectional view of the congress and to indicate some of the different interests assembled on an occasion such as this.

As pointed out by Dr. J. R. Mohler, Chief, Bureau of Animal Industry, Washington, D. C., "The greatest influence of the congress lies not in what we have already witnessed, but in the future of the poultry industry." To further capitalize on the tremendous impetus given the poultry industry on this occasion, action was taken at a final session by the united industries to carry on by further promoting consumer education in this country as to poultry and eggs on a national scale. Leadership to accomplish this gigantic task was delegated to an executive committee of 14 which has since been increased to 24. This committee will be aided by an advisory group of 48—one from each state. A report setting forth the results of certain studies and a plan of procedure is expected from this body about January 1, 1940.

This action should be of special interest to veterinarians since the further promotion of poultry meat consumption will no doubt necessitate an increased expansion of poultry meat inspection, supervision of sanitation in packing plants and many other duties which the veterinarian is best qualified to handle. In all probability the evisceration of poultry at the primary packing plants in the Middle West will become increasingly common, and each of these will need one or more well-trained veterinary inspectors.

It was generally conceded that Armour and Company "stole the show" among the large commercial exhibitors with their elaborate demonstrations on eviscerating poultry. Their glass-enclosed laboratory was besieged by spectators for each demonstration during the congress.

Secretary of Agriculture H. A. Wallace called attention in his opening remarks to the poultry industry which, he said, "is more vigorous and profitable than some other branches of agriculture. Poultry and eggs," he continued, "produced 12% of the total farm income in 1938, or nearly $1,000,000,000, which exceeds the total farm

income from any other farm commodity except milk, cattle and hogs. Fifty years ago the income from poultry was only 5% of the total farm income."

One commercial company attracted much attention with a series of transparent chickens in which were demonstrated normal, diseased and parasitized organs.

Featured at the entrance of the "Pageant of Poultry" was an attractive display of both live and mounted jungle fowl, said to be the progenitor of all domestic chickens. Beyond these were typical pairs of birds representing more than 100 breeds and varieties described in the American Standard of Perfection. This section was the poultry fancier's delight. In the Hall of Live Birds some 400 exhibitors entered about 5,000 birds which competed for honors. In addition to these, six foreign countries displayed 687 chickens, guineas, turkeys and water fowl.

In the writer's opinion, the feature in the live and dressed poultry exhibit which will be remembered longer than any of the rest, was the display of broad breasted turkeys. It was hard to believe such birds could be developed. Females weighed up to 23 pounds and males 42 pounds—a real sensation.

Popular, Consumer, and Scientific Programs

The popular program held each forenoon was popular in patronage as well as in name. Talks were given by internationally known speakers. The climax was reached when Tom Barron, for 50 years a successful Leghorn breeder of England, addressed an audience of 3,000 or more. The total attendance at these meetings was well over 17,000. These programs were supplemented by four, two-hour conferences which convened each afternoon. The attendance at these was limited only by the size of the room, which usually held 50 to 60 persons. The consumers' program attracted thousands of visitors at both the formal lectures and the demonstrations in the transparent kitchens.

Representatives from 21 countries presented papers on the scientific program. In addition to these, many other papers were read during the meetings held by the Poultry Science Association, the International Baby Chick Association, the Turkey Breeders' Association, the American Poultry Association, and many other groups. The turkey breeders organized a National Turkey Federation.

The youth program, which extended throughout the 11 days of the congress, was an innovation. There were about 2,000 in attendance from many states. Their contests and the entertainment by their bands and orchestras proved to be very much worth while. In fact, the youth program and the appeal made to consumers for the first time, were two outstanding features of the congress. The college students present succeeded in organizing a National Collegiate Poultry Club.

Displays and Exhibits

The 222 commercial exhibitions covered many acres of floor space. It didn't look as if anything relative to poultry or closely allied to it had been forgotten. Everything from the blocks of ice frozen in the shape of a chicken, to garden tractors, mammoth incubators with 78,000 egg capacity, and scores of articles and appliances between these extremes were on display. A legend in the American Feed Manufacturers' booth announced that 60,000 tons of poultry feed were supplied daily to poultrymen by the members of that organization—a staggering figure, especially when one realizes the small percentage of the total handled by this group.

In the Hall of Nations and States the United States government, three United States possessions, eight foreign countries, and 30 states had educational exhibits. Noteworthy among these was the United States exhibit, said to have been the largest ever arranged on a single subject, and the Canadian exhibit, which was unique in conception and complete and attractive to the smallest detail. The puppet show in the Ohio booth was original and clever.

Other Activities and Entertainment

The dedication of the peace monument and the presentation of the 28 cultural gardens sponsored by as many nationalities to the city of Cleveland on International Peace Day, July 30, was an impressive ceremony. Some 35,000 people attended these services in Rockefeller Park. Paul V. McNutt, head of the Federal Security Administration, was the principal speaker. This program was broadcast over a national hookup of 92 stations in this country and by short wave to many foreign countries.

The two afternoon teas given in Horticultural Gardens, each attended by 10,000 visitors; the ice hockey pavilion, in which the emblem of the congress was frozen in the ice, covering an area of about 40 by 50 feet; the Royal Canadian Mounted Police, the Canadian girls' Kiltie band, the Solomon, Kansas, F. F. A. orchestra, and many other features, kept congress visitors entertained.

The business firms in Cleveland did much in the way of window displays, street decorations, preparation of special menus and entertainment for the visitors. This was reported to have been the largest convention ever entertained in Cleveland.

Summary

The congress was pronounced a success by every standard. It was reported that more business was transacted than at all of the six previous congresses combined. The attendance doubled the highest expectation. The infant poultry industry, frequently dubbed the "sleeping giant," awoke to discover its tremendous strength. More than 5,000 persons, representing the U. S. D. A., every state, and every branch of the poultry industry, had coöperated in a common cause to stage this congress. As a result of their combined efforts all bills were paid and a small balance remained which will be used for educational work. There were 108 official foreign delegates present, and with visitors the number from abroad was increased to 185, not including Canada.

Prof. James E. Rice, general chairman of the congress, was elected president of the World's Poultry Science Association, which sponsors the World's Poultry Congress. While the place for the next congress, scheduled for 1942, has not been designated, it will probably be held in one of the European countries unless the war should interfere. The next congress will have less of the glamour created by the acres of commercial and educational exhibits. It will probably be largely a gathering of research workers and poultry scientists.

The Value of Accurate Diagnosis of Poultry Diseases

By C. P. FITCH and B. S. POMEROY, St. Paul, Minnesota

Division of Veterinary Medicine, University of Minnesota, Agricultural Experiment Station

IT HAS been said that "Reminiscing is a sure indication of senility." The senior author is fully aware of the truth of this statement, but we believe it necessary, in order to clear the horizon of many clouds which have obscured the sun's rays, to revert to the past in beginning this discussion.

Articles which have appeared in various journals on this subject are often sermons, more or less panegyrical in style, and not seldom, we believe, are passed over by the practitioner with such a remark as, "Well, I have had enough of that."

It is true, of course, that veterinary medicine, and practitioners in particular, have in many instances not assumed their proper place in the control of diseases of poultry. We believe this is changing. Veterinarians are becoming poultry minded. The transition, however, has occurred too late to avoid great unnecessary loss to the industry and also loss to the profession.

Students in veterinary medicine during the first decade of the present century received little instruction concerning diseases of what was then usually referred to as "barnyard fowl." The reason is obvious. Little scientific information was available, either in this country or abroad, on the diseases affecting this group of domestic live stock. Among works on poultry diseases extant at that time in this country was the account of Dr. Daniel Elmer Salmon, the first Chief of the Bureau of Animal Industry, on "Diseases of Poultry," and an excellent work[1] on diseases of poultry by Pearson and Warren. Read in the light of our present knowledge, however, these discussions appear very elementary and in some instances erroneous. Tuberculosis of poultry was investigated on the west coast (California and Oregon) during this period. Pullorum disease, the etiological agent of which was described by Rettger and his coworkers during 1901-1902, had not assumed countrywide importance. The application of the agglutination test for the detection of this disease was not described by Jones until the end of the period (1910). Parasites of poultry, both external and internal, were left to the professional parasitologist. We who were veterinary students in that decade heard something about "roup," but the information imparted was little in advance of that possessed by the average farmer.

Under these conditions how could veterinary students be given adequate instruction in this field? Essential information was lacking. Sufficient funds for carrying on studies of this group of live stock had not yet been appropriated by governmental and public agencies. Information could not be imparted which was not available. Poultry raising was a sideline in general farming and not regarded as of much economic importance. There was no worthwhile poultry industry in the strict sense of the word, although the combined production of the myriad small flocks was large. The "little red hen" was still the mother as well as the foster mother of the chick. Only with the development of the modern incubator and the commercial hatchery did the poultry industry begin the phenomenal expansion of recent years. Accompanying this growth came multitudinous methods of disease

[1] Part I, Diseases of Poultry; Part II, Enemies of Poultry. By Leonard Pearson, State Veterinarian of Pennsylvania, and B. H. Warren, Zoölogist, State Department of Agriculture. 749 pages. Profusely illustrated, including many full page plates in color. Half-leather binding. Issued by the state printer, 1897.

transmission. Poultry disease control was little practiced and less understood. Why shouldn't there have been a rapid and widespread extension of disease? Everything favored it and little, if anything, hindered it. Pullorum disease furnishes a good illustration. This disease was common throughout the eastern states during 1910-15. In 1919 the first case of pullorum disease in Minnesota was definitely identified. The source of the infection was traced directly to a shipment of eggs from Ohio for hatching purposes. The stage was well set for the rapid transmission of diseases of poultry, and disease rarely misses an opportunity for propagation.

■ We should not be surprised by the tremendous mortality from disease that confronts the poultry industry of today. This loss is appalling, often exceeding more than 70% of the chicks hatched. Extensive fatalities should have been foreseen. Some of the diseases of poultry at present of great importance did not exist in the early period following 1900, or if they existed, they were unrecognized. The complex of fowl paralysis had not entered the picture. Some of these recently recognized conditions were first described by the pioneers in poultry disease investigations in this country. Some of the early investigators were veterinarians. The veterinary schools were slow in recognizing the importance of poultry diseases and courses in poultry pathology were not introduced into the curricula until quite recently.

Ignorance always begets superstition. During this dark age and concomitant with the development of the poultry industry, there sprang up many self-styled poultry experts without technical training, and many "sure cures" for poultry diseases. These were perfectly logical sequences to the events that preceded them. Veterinarians were not equipped with scientific information to combat this wave of false teaching and most members of the profession were indifferent to it, and did not devote the time or attention to the old hen that her importance in the new scheme of things justified. We believe that they cannot be blamed too severely for this position. Small animal practice, which is now so important, went through the same stages; many refused to take it seriously until forced to do so by declining equine practice.

Poultry disease investigations have increased enormously during the present decade. Governmental agencies have at last come to the support of studies of the maladies of this group of live stock. Yet our present-day knowledge is still very fragmentary. The practitioner needs the help of the diagnostic laboratory for poultry diseases probably more than for the diagnosis of disease in any other group of animals.

Pullorum disease may be cited as an example of the value of the laboratory as an aid to the practitioner in handling disease in fowls. Modern investigations have shown that there are a group of diseases closely related to this infection, and that if the former be eliminated, these other paratyphoid infections closely resembling it may occur in a flock. Our laboratory has been studying this type of disease. A brief description of some of our results illustrate the point we are stressing, *i.e.*, the need and value of carefully conducted and properly controlled laboratory work in disease control.

During the past few years organisms belonging to the paratyphoid group have been recovered from the visceral organs of chickens, turkeys, ducks, pigeons, pheasants, quail and canaries. The term "paratyphoid" has been loosely used and sometimes has served as a "catch-all" for conditions other than pullorum disease and fowl typhoid. It should be limited to disease caused by Salmonella organisms other than *S. pullorum* and *S. gallinarum*. Paratyphoid infections are on the increase, and in the past year, the losses from this condition were as serious as those from pullorum infection.

Baby chicks or poults affected with paratyphoid organisms usually appear normal

until a short time before death, at which time some of the birds show ruffled feathers, drooping wings, malaise, inappetence, and a thin, watery, foamy diarrhea. The region of the vent often is soiled with fecal material. The diseased birds act as if chilled and huddle under the hover, holding the head under the wing or on the breast.

Autopsy findings are not definite. Some birds show accumulation of a serous fluid in the pericardial sac and the abdominal cavity. The intestinal mucosa in some cases may appear slightly reddened, and the lumen may contain a dark, viscid, mucous exudate. The gizzard and crop usually contain very little feed. The ceca may contain a hard, coagulated cheese-like material. This lesion in baby chicks or poults is quite significant and is usually considered as being strongly indicative of paratyphoid or pullorum infections. The liver may be enlarged, congested, and mottled.

Necrotic foci and abscessed areas are seldom present in paratyphoid infections, but are, however, usually present in the liver of the bird affected with pullorum disease. The lungs are usually congested but rarely contain abscessed areas and nodules such as are of common occurrence in pullorum disease.

The solution of the problem of paratyphoid infections depends upon the isolation and identification of the etiological agent of each outbreak. Even after a diagnosis of paratyphoid infection in a flock of poults or chicks is established, the immediate control measures are as general as those prescribed for pullorum disease, but to prevent the recurrence of such a disaster, the specific etiological agent should be identified if at all possible. It is impossible to identify organisms of the paratyphoid group without biochemical and serological tests. At one time the paratyphoid organisms isolated from chicks and poults were considered *S. typhi-murium (aërtrycke),* but on further examination serologically there now have been studied 17 different organisms of the paratyphoid group from chickens, turkeys, ducks, quails, pigeons and canaries. These organisms are *S. typhi-murium (aërtrycke), anatum, newington, senftenberg, derby, bareilly, new-*

Clifford Penny Fitch

port, oranienberg, kentucky, montevideo, bredeney, worthington, london, muenchen, minnesota, new brunswick, and *enteritidis.* Each organism has specific and non-specific antigenic characters.

Experimental work at this station has shown that in the case of *S. typhi-murium* (aërtrycke) adult turkeys may be carriers and *S. typhi-murium* has a cycle very similar to *S. pullorum* in chickens and turkeys. It also should be noted that if *S. typhi-murium* is present on the external surface of the egg shell, the organism is capable of penetrating the shell and infecting the embryo. In all probability adult carriers affected with other members of the paratyphoid group exist. This aspect of the infection is now being studied. It is known that *S. anatum* infection in ducks has a life cycle similar to *S. pullorum* and *S. typhi-murium.*

As stated earlier each organism has specific and nonspecific antigenic characteristics; thus these organisms are capable of stimulating the formation of agglutinins. For example, a turkey artificially fed *S. pullorum* of turkey origin will have an antibody response not only to *S. pullorum* but also agglutination reactions may occur with

antigens prepared from *S. anatum, bredeney, typhi-murium, senftenberg, worthington, newington, derby, and enteritidis.*

Thus it can be seen that the problem of control of pullorum disease and paratyphoid infections requires the coöperation of a diagnostic laboratory for the isolation and identification of the etiological agent. Let us illustrate: A turkey farm near our laboratory had difficulty with some baby poults. There existed on this farm the several units necessary to handle 10,000 poults. The poults were procured periodically from three different hatcheries during the spring of the year. Losses occurred in the first group received. A paratyphoid organism was isolated. A few weeks later a group was received from the second hatchery and losses also occurred. A similar experience was encountered in a group of poults received from the third hatchery. Paratyphoid organisms were isolated from each group. With this history the owner was convinced that the infection was introduced onto the farm by the first group and had then spread to the other groups. This, of course, could have been possible, but when the organisms were identified, not one but four specific organisms were isolated. Inasmuch as the organisms of each group were entirely separate and distinct, the hatcheries were regarded as being equally responsible for the introduction of the infection.

■ The production of turkeys for market and turkey eggs for hatching has markedly increased during the past 15 years. During the early days, the raising of turkeys was largely confined to the New England and Middle Atlantic States. Disease has changed this picture. Turkey raising became nearly impossible in these districts because of the enormous losses, largely from blackhead. Coccidiosis and internal parasites also took their toll.

In connection with studies of blackhead or infectious enterohepatitis the Division of Veterinary Medicine at University Farm carried out extensive unpublished experiments in raising turkeys in confinement many years ago. We were never sure when we purchased turkeys that they were free of this disease. Freedom from the disease was a necessity in connection with our inoculation experiments. We demonstrated in coöperation with our Poultry Department that disease-free turkeys could be raised successfully, in very close confinement. These and similar results were nationally popularized by Dr. W. A. Billings of our Extension Department. Today turkey raising is a prominent part of Minnesota's agriculture, as well as of the agriculture of numerous other states, particularly Texas. During the interval that has elapsed since those earlier experiments we have learned a great deal about diseases of turkeys. We are far, however, from having a complete knowledge of the infections of this group of domestic live stock as well as other species of birds. A brief description of an outbreak of disease that occurred this summer in a flock of turkeys located near University Farm illustrates one of the numerous new problems that are constantly confronting those who are concerned with the welfare of the poultry industry.

The flock consisted of approximately 5,000 birds of four age groups. The disease appeared during late June, in the youngest birds, which were about 12 weeks old, but has since made its appearance in two older groups. It has not as yet appeared in the oldest group of turkeys, which was hatched in February. Only a few birds at a time became affected. The birds first become listless and show symptoms of incoördination and in a few hours develop twisted necks (Figs. 1 and 2). Some live for several days if protected from the flock. Approximately 275 birds have developed this syndrome with about 75% mortality. The condition has been in progress for three months and even during the present month, September, new cases are still developing.

The entire flock received the same feed, and feed from the same source was used in a neighboring flock of several thousand birds, which have, up to the present time, remained free of this disease. The birds were maintained as separate age units on

June grass range and upon the appearance of the disease, they were moved every two

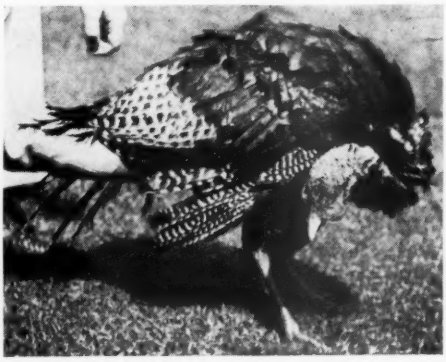


Fig. 1. Turkey showing "twisted neck."

to three days to new range for several weeks. To date, they have been moved over a half mile from the original range.

Laboratory examinations of many of the diseased birds have been made. Aërobic cultures prepared from the internal organs and brains have been negative. Histopathological examination of the brain has shown in some cases cuffing of the small capillaries, leucocytosis, and hemorrhage. The internal organs have shown no significant changes grossly or microscopically. A brain filtrate was inoculated intracranially into guinea pigs, chickens and turkeys. The guinea pigs showed no ill effects from the inoculation and were afterwards found susceptible to equine encephalomyelitis virus, Western strain. The chickens and turkeys did not tolerate the intracranial inoculation, dying in less than 18 hours. Guinea pigs that received, intraperitoneally, blood and suspensions of internal organs survived.

Sick birds treated with botulinus antitoxin A, B, and C, and encephalomyelitis serums showed no significant response.

There were spontaneous recoveries in untreated birds. Neutralization tests with botulinus toxin and encephalomyelitis viruses are now being carried out with the serums of recovered birds. It can be seen readily that it sometimes requires extended laboratory experiments to make definite diagnoses of poultry diseases. We still do not know the exact nature of this malady.

■ It is going to take a good many years to repair the damage already done by dis-

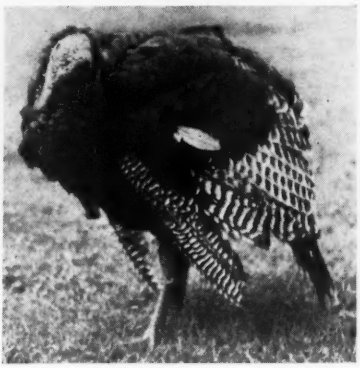


Fig. 2. Turkey in less advanced stage of the disease.

ease to the poultry industry. Changes are coming very slowly, but they *are* coming. Practitioners are realizing more than ever before the importance of the poultry industry and are devoting more and more attention to it. We believe that veterinarians should do more reading in this field, and we particularly wish to call to their attention *Poultry Science,* the official journal of the Poultry Science Association. This journal publishes not only articles relating to poultry husbandry but also very excellent discussions of diseases affecting domestic fowl. Research activities have provided information that permits practitioners to render a real service to the poultry industry.

It would be decidedly worthwhile for the veterinarian to allot more of his time to the diseases of poultry. This statement is made on the basis of the value of poultry and poultry products. Veterinary practice is to a large extent founded upon economic principles. The greater the value of a group of live stock, the greater should be the revenue that is derived therefrom by the veterinarian.

The Diagnosis of Poultry Diseases*

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THE veterinarian of today attaches too little importance to the technique of holding an autopsy or post-mortem examination on poultry. Diseases of poultry are no more difficult to diagnose than those of other animals, yet many veterinarians neglect this important practice.

Fig. 1. A bird held in position to break the neck.

Before attempting to make a post-mortem examination, all possible information should be obtained as to field history: the number of birds in the flock; how many are affected; how many died; when the disease was first noticed; age of affected birds; what symptoms has the owner observed, etc. Such information should help in arriving at a diagnosis.

The first condition to be considered is the external appearance of the live bird. Note whether it appears droopy, lame, blind, or emaciated. Examine for discoloration of the comb and wattles, condition of nasal sinuses and mouth, presence of external parasites, body temperature, etc. The symptoms exhibited by a living bird may be of considerable value in indicating a certain disease, but a post-mortem examination will usually lead to a more exact diagnosis. Birds that have been dead for several hours are very unsatisfactory for examination because post-mortem changes occur so rapidly that the lesions may be obscured.

Post-Mortem Examination

The best method of killing a bird is to break its neck. To do this grasp the legs and wings in the left hand and the head in the right hand in such a way that the back of the head rests in the palm of the hand with the base of the skull between the thumb and forefinger. Grasp the head firmly and pull slowly down and at the same time turn the head back until the cervical vertebræ are disarticulated (Fig. 1). If this be carefully done the skin is not broken and blood is not lost.

Instruments necessary for autopsy are scalpels, bone cutters, scissors, enterotomes, a tray and a microscope.

Several minutes after the bird has been killed, the feathers should be thoroughly wet with water. To expose the internal organs the skin should be incised between the legs and body, and the legs pulled down and away from the body until the hip joints are disarticulated. The remaining skin is cut across just posterior to the xiphoid process of the sternum and pulled forward and back exposing the abdominal muscles, crop and neck (Fig. 2). The muscles back of the point of the xiphoid process of the sternum are cut with a pair of scissors. The cut is continued forward through the ribs on each side in the direction of the attachment of the wings. The coracoid and clavicle (wishbone) may be cut with heavy scissors or post-mortem shears. Care should be employed not to injure the internal organs during the above operation, which exposes the liver, heart, lungs, spleen

* Contribution No. 189 from the Department of Bacteriology, Kans. Agr. Exp. Sta.

and intestines (Fig. 3). These should be examined carefully for size, color, consistency, etc., before being removed. After this examination is complete, the organs may be removed and dissected. The intestines should be removed and opened from end to end with a pair of enterotomes. A careful examination should be made for thickening of the walls, tuberculous nodules, hemorrhages, and worms. The contents of the gizzard and crop should be examined carefully and the odor noted. The contents of the gizzard normally have a sour odor but in some cases, as in botulinus poisoning and trichomoniasis, they may have a putrid odor. The esophagus and trachea should be dissected out and split open for examination. In some cases of fowl pox and tracheitis the upper portion of the trachea may be plugged with exudate, while in a certain nutritional disease the esophagus may be covered with nodules. The heart, kidneys, lungs and reproductive organs should be carefully examined for signs of abnormality.

Fig. 2. Stage in the autopsy of a bird showing the skin properly pulled back and the external muscles exposed.

Fig. 3. Stage in the autopsy of a bird showing the floor of abdomen and thorax removed and the viscera exposed.

When performing the examination, good light is of primary importance so that small variations from the normal may be easily noted. Throughout the examination meticulous care should be taken to prevent contamination of ground or objects, with which other fowl may come into contact, with disease organisms or to adequately disinfect such articles if contaminated.

Diagnosis of Poultry Diseases

Although some diseases may be diagnosed as easily in the field as in the laboratory this is usually not the case.

Below have been included some of the procedures which are of value as an aid to a more accurate differential diagnosis of the poultry diseases common in America.

There are a number of factors or conditions that must be considered in making a diagnosis: season of the year, weather, age, and feeding practices. Fowl typhoid occurs most commonly during the summer months, cholera in wet and cold weather of late winter. Respiratory and nutritional diseases of mature birds are more prevalent during the season when birds are closely confined. The feeding of too high levels of protein and an unbalanced mixture of minerals may produce disorders and loss.

Coccidiosis

Coccidiosis is a protozoan disease that is found most often in chicks from two weeks to four months of age, although older birds may be affected.

The clinical symptoms and post-mortem lesions of coccidiosis depend upon the species of coccidia involved. Chicks suffering from coccidiosis usually show droopiness and great depression. They stand huddled, with wings and head dropped, feathers ruffled and eyes closed. Paleness of the comb, wattles and shanks is observed in the later stages of infection. The greatest losses occur within six to 10 days following the onset of the first symptoms. Diseased chicks may recover but if infection has been severe the survivors are usually unthrifty.

In mature birds the most common type is the chronic intestinal form. The symptoms observed are anemia of the comb and wattles, loss of appetite, gradual emaciation, and ruffled feathers. Usually only a few birds are affected at one time. Diarrhea may or may not be present. Leg weakness and paralytic symptoms may be observed in coccidial infection in range and mature stock.

Post-mortem Appearance.—The lesions are usually confined to the small intestine and ceca. Whether the lesions are intestinal or cecal, depends upon the species of coccidium involved. In some outbreaks both may be present, and marked lesions may occur in both the ceca and intestine. In the acute form of coccidiosis, in which the site of infection is the ceca, these organs may be swollen, dark red in color and firmer than normal. The lumen may be filled with blood, and in the latter stages a necrotic mass of yellowish, cheesy, blood-stained material may be observed. The acute intestinal lesions vary from a catarrhal enteritis with pronounced thickening of the mucosa to a severe hemorrhagic enteritis with the presence of free blood in the lumen. In growing or mature stock a catarrhal enteritis with small grayish-white spots in the mucosa is most frequently observed.

Diagnosis.—A positive diagnosis of coccidiosis cannot be made with complete assurance from symptoms alone because in general they resemble those of some other diseases, such as those due to worms, or nutritional disease. It is, therefore, necessary that a bird be sacrificed and a microscopic examination made. Such an examination is easily made by placing a small amount of suspected bowel scrapings or contents upon a clean microscopic slide, placing a cover slip on the material and gently pressing it into a thin layer. This, the oldest and simplest method, is known as the smear method. If oöcysts are present they appear as round or oval bodies, having a double-lined wall with a dark, round, central portion surrounded by a clear zone.

If no coccidia are found by this method, the flotation method should be used. It consists of placing some of the suspected material in a dense solution of sugar or salt and centrifuging, or allowing the material to stand for several hours if no centrifuge is available. The high specific gravity causes the coccidia to rise to the top of the fluid, from which the film may be taken and examined. The concentrated

sugar solution as used by Sheather[1] is prepared by adding 500gm (one pound) of granulated sugar to 360cc (12 ounces) of water. Mix thoroughly and place in a double boiler or water bath and heat slowly until all sugar is dissolved. Do not heat to the point where the water evaporates, as the sugar may crystalize out when cool. Allow the solution to cool before removing it from the water. Add 6.5cc (1%) of melted phenol crystals to the solution. A saturated salt solution may be substituted for the sugar solution.

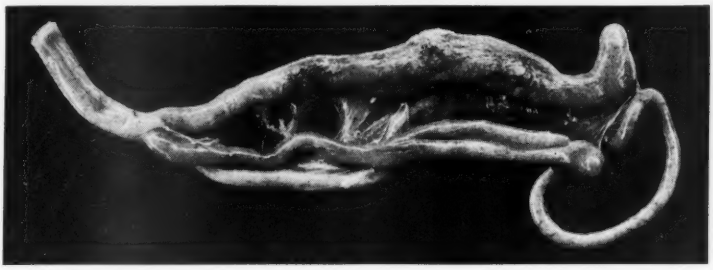

Fig. 4. Lesions of blackhead. The left cecum was involved, being swollen and ulcerated in a manner characteristic of blackhead. The right cecum was normal.

Blackhead

Blackhead (infectious enterohepatitis) is caused by a microscopic protozoan organism *Histomonas meleagridis*. It is primarily a disease of turkeys, but other fowl are sometimes affected.

Symptoms.—The first indications of the disease are droopiness and sluggishness; the affected bird is unable to keep up with the flock and remains standing or sitting in one place. As the disease advances, there is increased weakness and emaciation. A sulphur-colored diarrhea is usually present; inappetence becomes marked, and drooping of the head and wings is noted. The disease runs a rapid course in young birds; poults may die without manifesting any visible symptoms. In older birds it usually causes death in three or four weeks after the first indication of infection.

Post-mortem Findings.—The lesions of blackhead are usually confined to the ceca and liver. One or both ceca may be greatly enlarged and filled with a solid, yellowish, cheese-like, foul-smelling, necrotic mass (Fig. 4). The inner surface may show ulcerated areas and blood is usually found on the outer surface of the necrotic mass. The liver is often affected; it is enlarged and spotted with round, sunken, ulcer-like areas of yellowish-green or dark red color.

Peritonitis with adhesion is not uncommon in those cases in which the liver or ceca may be extensively involved.

Diagnosis.—The presence of the lesions and symptoms mentioned above is highly indicative of blackhead. A positive diagnosis is dependent upon demonstration of the organisms under a microscope. This procedure is also of value in differentiating blackhead from coccidiosis when only the ceca may be involved in very young poults.

Trichomoniasis

Trichomoniasis is an infectious protozoan disease of chicks and turkeys. It is caused by a protozoan parasite belonging to the genus Trichomonas. Several species have been identified. *T. pullorum* affects chicks and *T. diversa,* turkeys.

Symptoms.—Turkeys of all ages are susceptible. The systemic symptoms are identical to those observed in blackhead. Drooling from the mouth consisting of a whitish, thick, mucus-like fluid and retention of a very putrid fluid in the crop is commonly encountered. One of the characteristic symptoms is frequent attempts at deglutition.

In poults this disease produces symptoms identical with those of pullorum infection. The symptoms observed in birds

[1] Sheather, A. L., 1923. *Jour. Compar. Path. and Ther.* 36:266-275.

three to four months of age at this laboratory were inappetence, loss of flesh, dullness, increased thirst, and feathers ruffled and unkept.

Post-mortem Findings.—The lesions in turkeys are very characteristic, especially those of the crop, upper and lower esophagus, and the anterior portion of the proventriculus. Peculiar yellowish ulcerative areas with a concave base and elevated center of one-fourth inch or more in diameter are observed in the advanced stages, while sprout-like elevations of necrotic material are sometimes observed in the early stages. They may coalesce to form larger areas. These are firmly adherent to the underlying tissues and may become so extensive as to occlude the lumen of the lower esophagus. This condition explains why frequent attempts of deglutition are observed in some of the living birds. The posterior surface of the proventriculus is usually covered with a grayish, thick, gelatinous film.

In chicks there are no characteristic lesions. The ceca may be somewhat enlarged and filled with a thin, slimy fluid. Levine and Brandly[4] stated that in older birds the gross lesions resemble those observed in the turkey and pigeon. Caseous necrotic foci were observed on the mucous membrane of the crop, anterior proventriculus and esophagus. The mortality is usually very low.

Diagnosis.—Trichomoniasis can often be detected in the living bird by examining the mouth and upper esophagus providing lesions are present. A wet mount examination of the crop material will usually reveal large numbers of active trichomonads. Advanced cases of trichomoniasis are easily diagnosed upon autopsy by the presence of the characteristic lesions described, and the presence of large numbers of trichomonads upon a wet mount examination. If the bird has been dead for 30 minutes or longer, the flagellates lose their motility and are very difficult to recognize.

[4]Levine, N. B., and C. A. Brandly, 1939, *J.A.V.M.A.*, July.

Pullorum Disease

Pullorum disease, an infectious disease caused by *Salmonella pullorum*, affects both chicks and adults. In chicks the disease is usually very acute and the death rate high. This however, depends largely on the manner in which the chicks are managed. In adults the infection is usually localized in the ovaries or other organs and rarely produces visible lesions.

Symptoms.—In chicks there are no symptoms that are of particular diagnostic value. The disease usually appears immediately upon hatching with the highest mortality occurring between the seventh and the 14th day, depending upon the severity of the infection. The chicks appear stupid, remain under the hover and stand around with their eyes closed; their feathers become rough, a loss of appetite is apparent, and the wings droop. The characteristic whitish discharge from the vent soon makes its appearance, and in many cases this clings to the down in such quantity as to occlude the vent and cause the condition known as "pasting up behind." Chicks suffering from an acute type of the disease may die before symptoms of diarrhea appear. Therefore, the absence of diarrhea does not eliminate pullorum infection. Many of the affected chicks utter a sharp cry or peep continually until they become too weak to stand and then fall over and remain on their side or back, showing few signs of life until death.

Post-mortem Findings.—Chicks that die during the first week seldom show any characteristic lesions that are not found in chicks dying from other causes. Chicks that die after the first week are more likely to show constant characteristic lesions. These consist of small, grayish, firm nodules or necrotic areas in the liver, heart, lungs, and sometimes in the intestines. The ceca of infected chicks are frequently thickened and contain cheesy material. Adult fowls affected with pullorum disease seldom show any outward symptoms, so that it may exist in a flock without being recognized. The infection is usually

localized in the ovaries, but may be found in other parts of the body or it may be generalized. Infection of the ovaries is characterized by the presence of angular, firm, discolored ovules, varying in size, one or more of the ovules being affected. The heart and testes are usually affected in the male. Acute septicemic outbreaks sometimes occur in adult fowls.

Diagnosis.—An accurate diagnosis of pullorum disease in chicks can be made only by a post-mortem examination of a representative number of typical specimens together with a bacteriological examination. Cultures are usually made of the heart's blood, liver, yolk-sac, intestines, lungs and bone marrow in case the chicks have undergone post-mortem changes. Eosin methylene blue agar plates are very satisfactory in differentiating and isolating the *Salmonella pullorum* organism from the hordes of other bacteria that are sometimes present. *S. pullorum* organisms produce small, smooth, transparent, colorless colonies on this medium within 24 hours.

Sugar fermentation tests constitute a simple and accurate means of identifying this and other of the more common bacterial diseases of poultry.

Diagnosis may also be made by taking several loopfuls of a heavy suspension of the organisms in question on separate areas on a glass plate and adding several loopfuls of known positive and negative pullorum serum. Clumping or agglutination by the positive serum indicates *Salmonella pullorum,* or the organism of fowl typhoid.

In the adult living bird, one of the approved agglutination tests may be employed to detect pullorum carriers, permitting their removal from the flock.

Fowl Typhoid

Fowl typhoid is an acute infectious disease of fowls caused by *Shigella gallinarum.* The disease is usually observed during the hot, dry months and is seldom observed during the cooler months and winter.

Symptoms.—Birds affected with fowl typhoid show loss of appetite, general progressive weakness, loss of flesh and high fever which is manifested by an increased thirst.

The affected bird is listless, the head is drawn in close to the body with the eyes closed, the feathers are unkempt and the wings are allowed to sag. The head comb and wattles are usually paler than normal, but in acute cases may be darkened due to venous congestion. The droppings have a yellowish or greenish color and often a very fetid odor is noted. Five or six days after symptoms are noticed the birds usually die, although a few may recover.

Post-mortem Findings.—Upon opening a dead bird an enlarged darkened greenish or mahogany-colored liver with minute necrotic grayish spots is observed. The spleen is often swollen, enlarged and mottled in appearance, and the gall-bladder distended with thick bile. The kidneys may be enlarged and friable. The heart appears normal or pale and may also show grayish necrotic spots on its surface. A low grade of inflammation is usually found in the intestinal lining, and the intestinal contents are slimy and bile stained. The blood is thin and watery and usually fails to clot.

Diagnosis.—A positive diagnosis can be made only by laboratory procedures. If laboratory facilities are not available or

TABLE I. SUGAR FERMENTATION TESTS

	Dextrose		Maltose		Sucrose		Lactose		H_2S	Indol
	a	g	a	g	a	g	a	g		
Salmonella pullorum	+	+	−	−	−	−	−	−	+	−
Salmonella typhi-murium	+	+	+	+	−	−	−	−	+	?
Shigella gallinarum	+	−	+	−	−	−	−	−	−	−
Pasteurella avicida	+	−	−	−	+	−	−	−	−	−
Escherichia coli	+	+	+	+	+	+	+	+	−	+

a = acid g = gas + = positive − = negative.

the owner is not willing to pay for such an examination, a diagnosis must depend upon the symptoms and lesions enumerated. The mahogany-colored liver is a rather characteristic finding and is highly suggestive of fowl typhoid. The laboratory procedure consists of isolation and identification of the causative organism. *Shigella gallinarum* is found in large numbers in the heart's blood, liver, spleen, etc., and will readily grow upon the common laboratory media. The common procedure employed by this laboratory consists of streaking a 10% blood agar plate and an eosin methylene blue agar plate from the blood, liver, and spleen.

Fowl Cholera

Fowl cholera is a highly infectious disease of all domesticated birds. It is caused by a specific organism, *Pasteurella avicida*. The disease is characterized by sudden onset and rapid spread throughout the flock.

Symptoms.—If the disease is very acute, frequently no symptoms are noticed except that the birds are found dead in the yard, on the nest or under the roosts. A yellowish diarrhea is sometimes but not always a symptom. In peracute cases the birds die before a bowel disturbance occurs. The comb, red at first, later turns a purple color. The temperature is elevated, loss of appetite is common and the bird exhibits excessive thirst. Other symptoms that are present are extreme drowsiness, ruffing of the feathers, and an increase of mucus in the respiratory tract resulting in a gasping or choking sound as the bird breathes. Death usually occurs in 12 to 24 hours, although in chronic cases birds may linger for several weeks.

The chronic type generally follows an acute attack and is characterized by an intermittent or persistent diarrhea with smearing of the vent feathers, emaciation, paleness of the comb, occasional edema of the wattles, the wings and tail droop. The chronic type of cholera is often confused with fowl typhoid. A peculiarity of an outbreak of fowl cholera is that it frequently terminates as suddenly as it started. However, the disease usually reappears some months later.

Post-mortem Findings.—The anatomical changes found on autopsy depend upon the duration of the disease. In very acute cases there are often no gross lesions that indicate the cause of death. Subacute or chronic cases usually reveal small petechial and sometimes ecchymotic hemorrhages on the heart, lungs and serous membranes.

In subacute or chronic cases the lungs may be dark red in color and sometimes pneumonic. The duodenal portion of the intestine is highly inflamed and hemorrhagic and the contents are often blood-tinged, while the contents of the remaining portion are sticky and yellowish in color. The pericardial sac usually contains an excessive amount of fluid and sometimes flakes of fibrin. The liver and kidneys are highly congested and friable. Ovarian changes are not uncommon and are manifested by rupture of the yolk, forming a yellow, cheese-like material in the abdominal cavity which is usually adherent to some organ.

Diagnosis.—Positive diagnosis of fowl cholera is dependent upon the symptoms and lesions enumerated and the isolation and identification of *Pasteurella avicida*, the causative agent. If there is a history of sudden death of a number of birds in an apparently healthy flock and if on autopsy numerous hemorrhages are present on the serous membranes, particularly on the heart, fowl cholera may well be suspected. The same procedure for isolation and identification may be employed as for fowl typhoid. The organism exhibits a bipolar staining when smears are made from blood or tissues and stained with a dilute solution of carbol fuchsin (1:10) provided staining is not too long. Wright's stain will show this characteristic very satisfactorily. The finding of bipolar organisms in the blood and other tissues is diagnostic of cholera. The fact that the organisms are not present in sufficient numbers in the blood stream in chronic cases makes this procedure unreliable as a routine procedure for diagnosis.

Fowl Tuberculosis

Fowl tuberculosis is a chronic infectious disease of fowls. The disease is caused by *Mycobacterium tuberculosis-avium.* A typical history is usually presented in a diseased flock. The flock owner reports that his losses consist of two or more a week (or in some cases only two or more a month), and that the losses occur only in birds over one year of age. The term "going light," is commonly used by the poultryman to describe this disease.

Symptoms.—Infected birds slowly become emaciated to a point where they are practically skin and bones. Durant[2] states that there is no other disease in which there is such extreme emaciation and thinness. It is impossible to recognize the disease in the early stages, while swollen joints, lameness, anemia, diarrhea and general weakness may be noted in the latter stages.

Post-mortem Findings.—The lesions commonly seen are grayish to yellowish tubercles of various sizes, few to many in number and situated on the surfaces of the liver, spleen and intestine. The spleen is usually enlarged, and tubercles are less frequently found in the peritoneum, kidneys, joints, and other structures. The lung is seldom affected. The tubercles when incised are tough and contain a cheese-like material which is more or less caseated and firm, but never gritty.

Diagnosis.—A positive diagnosis is made by microscopic examination of affected tissue and the finding of acid-fast bacteria. The tuberculin test may be used to diagnose tuberculosis in the living fowl. An intradermal injection is made into the wattle. The presence of characteristic tubercles in the liver, spleen and intestine is highly suggestive of tuberculosis but these should not be confused with similar lesions caused by other conditions such as tumors of the abdominal organs, and nodules produced by a certain species of tapeworm. Previous infestation with coccidia sometimes produces minute specks on the liver. Blackhead lesions may be differentiated from tuberculous lesions in that the tubercles are raised above the surface and upon palpation are firm and granular, where in the former (blackhead) the lesions in the liver appear more regular in outline, sunken and ulcer-like.

[2] Durant, A. J., 1936. Agri. Exp. Sta. Bul. No. 364.

Botulism

Botulism (limberneck) is an infectious disease affecting primarily the nervous system. It is caused by the preformed toxins of a microörganism, *Clostridium botulinum,* that is commonly found where food and grain have spoiled, or in decaying carcasses. Two types, A and C, of the organism are known to affect poultry.

Symptoms.—The first indication of the disease as observed by the flock owner is the sudden appearance of several cases of typical limberneck. This condition is caused by paralysis of the neck, which makes it impossible for the bird to raise its head from the ground. It must not be confused with wry neck as sometimes observed in leucosis, a heavy infestation of worms, or coccidiosis. The affected birds are found lying in a prone position and when picked up frequently utter a sharp cry. The feathers are very loose and may be easily plucked. In the early stages the comb and wattles are a bright red color in contrast to an anemic or cyanotic color as observed in most of the infectious diseases.

Post-mortem Findings.—Upon autopsy the crop or gizzard frequently contains a number of maggots and bits of decomposed meat, or spoiled grains, other food, or feathers and bones that contain the toxin. A very putrid odor is usually present. The meninges are usually found to be highly congested.

Diagnosis.—The diagnosis of botulism is dependent upon the symptoms—limberneck, paralysis, and the ease with which the feathers may be plucked. Botulism produces no lesions that are of diagnostic value. An examination of the premises will often support the diagnosis by revealing decaying carcasses of birds or other animals that have been partly eaten by the poultry. Or maggots may be found in the crops of dead or dying birds, indicating they have been eating putrid flesh.

Paratyphoid

Paratyphoid is an infectious disease of chickens, turkeys, pigeons, ducks, geese, and wild birds. The disease is caused by certain numbers of the Salmonella group other than *Salmonella pullorum*. It is primarily a disease of young stock although old birds may become infected and remain carriers. The disease is manifested by droopiness, diarrhea, inappetence, unthriftiness and ruffled feathers. The affected birds huddle together and act as if they were chilled. The lesions are not constant and are therefore of no diagnostic value. The diagnosis is dependent upon isolation and identification of the causative organism.

Fowl Pox

Fowl pox (also known as avian diphtheria, canker, chicken pox, etc.) is a highly infectious disease of fowls caused by a filterable virus. Two forms of fowl pox may be observed, the skin type and the diphtheritic type; they are but different manifestations of infection with a single virus. The two forms may be observed in the same bird.

Symptoms.—The skin type is characterized by the development of small, smooth, grayish, blister-like eruptions which may vary in size. These may coalesce and form large areas on which a hard, dry crust develops. When these scabs are removed the underlying surface is raw and bleeding. The lesions are most commonly observed on the comb, wattles, and corners of the mouth and eyelids, and less frequently on the earlobes, legs, feet, about the vent, and under the wing (Fig. 5). Generally no systematic reaction is noted if the infection is light, but in laying flocks the egg production is greatly reduced or stopped.

The diphtheritic type of fowl pox is characterized by the formation of croupous membranes (pseudomembranes) on the mucosa of the mouth, throat, nasal cavity, etc. As the disease progresses, these areas become larger and may interfere with breathing and prehension of food. Other symptoms that may be observed are weakness, emaciation, and dullness.

Diagnosis.—A diagnosis is dependent upon the presence of typical pox lesions as described. However, virus bodies may be observed by means of a high-powered microscope and proper methods of staining.

Infectious Laryngotracheitis

Infectious laryngotracheitis is a highly infectious disease of fowls. It occurs primarily during the housing season in wet, cold weather.

Fig. 5. Typical fowl pox eruptions (natural infection).

Symptoms.—The first symptoms commonly observed by the flock owner are difficult breathing with extension of the head and neck and with the beak open upon each inspiration. There is usually a rattling noise caused by excessive accumulation of exudate in the larynx and trachea. The bird sometimes shakes its head vigorously in order to dislodge the exudate. As the disease advances the bird assumes a sitting position, allowing the wings to sag and the beak to rest on the ground. The mouth and nasal passage are frequently filled with a thick mucoid exudate. In severe outbreaks death usually occurs within three or four days after symptoms are first noted. Others succumb in seven to ten days. The body temperature is increased.

Post-mortem Findings.—The wall of the trachea may show intense inflammation and hemorrhage. The trachea is partly filled with exudate sometimes mixed with

blood. In many cases death appears to be due to suffocation following a plugging of the trachea with a mass of cheesy material.

Fig. 6. Infectious Bronchitis.

The lungs are normal but sometimes may show areas of congestion.

Diagnosis.—The rapid spread and the finding of symptoms and lesions enumerated suggest the presence of infectious laryngotracheitis. There is no practical laboratory diagnosis. A positive diagnosis is dependent upon cross immunity tests with infectious bronchitis.

Infectious Bronchitis

Bronchitis is a highly infectious disease of chicks caused by a filterable virus. This virus is immunologically distinct from that of laryngotracheitis. This means that birds immune to one disease may contract the other.

Symptoms.—The disease may appear a day or two after hatching, occurring most commonly between the second and ninth day. Older birds, if affected, recover more rapidly. The symptoms are gasping and suffocation (Fig. 6). In the more advanced cases the wings sag, the feathers become ruffled, the chicks become progressively weaker and huddle under the brooder. The chicks sometimes emit a hoarse chirp during the gasping period. A mucous exudate is present in the nasal passage.

Post-mortem Findings.—The lungs are congested and the bronchi contain considerable exudate which may even occlude the lumen, resulting in bronchopneumonia. The upper trachea is rarely affected. This aids in distinguishing the disease from laryngotracheitis.

Leucosis

Leucosis is a general term used to characterize a group of disease conditions which are not well defined. The cause has been demonstrated to be a virus. It is the most destructive disease of fowls in Kansas.

Symptoms.—These vary depending upon the form present. Neurolymphomatosis is

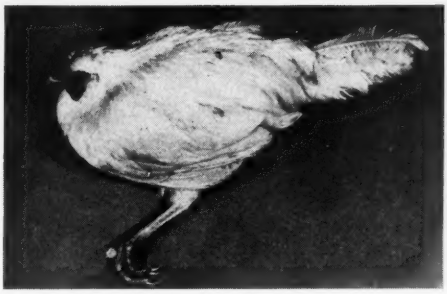

Fig. 7. Paralysis of Left Leg in Neurolymphomatosis.

manifested by a paralysis of one or both legs (Fig. 7). The legs and toes are usually in a flexed position and not capable of supporting the weight of the body and frequently the bird will lose control of the neck and a wing. The onset is sudden; birds appearing healthy will suddenly become lame in one or both legs or lose control of the wings or neck. The appetite is usually retained, but paralysis of the legs, wings, or impaired vision usually makes it impossible for the affected bird to obtain food and water, and as a result, rapid emaciation and digestive disturbance manifested by greenish discoloration of the droppings, are commonly observed. Many birds develop a condition of the eye known as "glass eye" or "pearly eye" because of the peculiar bluish-gray color and in advanced cases some of the tissues of the eye are destroyed, resulting in blindness. Some

birds with gray-eye appear to be healthy and may even continue to lay for some time. This condition is usually observed in adult birds.

Other symptoms sometimes observed consist of skin tumors and paleness of the skin and wattles. The duration of the disease varies from a few days to many weeks; complete recovery is rarely observed.

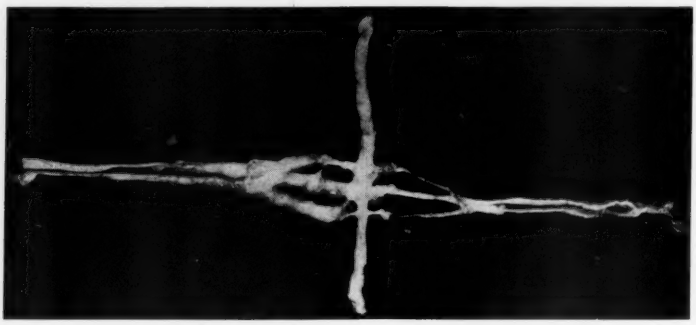

Fig. 8. Neurolymphomatosis. The left ischiatic nerve is involved; the right is normal.

Post-mortem Findings.—In the paralyzed fowls the large nerves as well as the nerve plexuses of the leg and wing supplying the affected part usually show marked changes. The nerve may be swollen and enlarged to several times its normal size. The enlargement may extend the entire length to the nerve endings or only one or more parts of the nerve may be swollen and enlarged, (Fig. 8). On microscopic examination, the nerves and some of the involved tissue are filled with masses of round, lymphoid-like cells which give the appearance of a tumor. Tumor-like masses (lymphocytoma) are not commonly seen in cases of fowl paralysis.

In lymphocytoma the liver is often enlarged to an enormous size; is a grayish-red in color and upon palpation is very soft and flabby. The entire organ is very friable and not infrequently death is found to have been caused by internal hemorrhage. The ovary, spleen, kidneys, heart, and other tissues may be the site of tumor formation.

Diagnosis.—Observations of the symptoms and lesions enumerated is highly suggestive of leucosis. Definite diagnosis of leucosis is made only by a microscopic examination of stained blood smears or tissue sections.

Nutritional Diseases

A-avitaminosis (nutritional roup) is a disease of fowl due to a deficiency of fat-soluble Vitamin A in the ration. It is usually recognized only in advanced stages, and birds four to 12 months of age are most commonly affected. Poults require a larger quantity of Vitamin A in the ration than chicks.

Symptoms.—In young birds the disease is characterized by a gradual appearance of unthriftiness and droopiness. This is followed by lameness or by a staggering gait and finally the birds are unable to stand. The eyes become sensitive to light and a white caseous deposit occurs beneath the eyelids. A differentiation should be made between ocular roup and the roup-like condition seen in A-avitaminosis. In the former the exudate is more yellowish and cheesy and usually has an offensive odor. In nutritional roup the exudate is nearly white, without a putrid odor, and is easily removed from the eye.

Post-mortem Findings.—The kidneys are pale and the tubules are distended with urates. In advanced cases the mucous membranes of the mouth, throat and esophagus will show small whitish or yellowish raised nodules. In young birds the bursa of Fabricius becomes distended with a white exudate.

D-avitaminosis (Rickets).—Vitamin D deficiency results in the development of rickets, a condition which is quite common in poultry. The requirements for this vitamin are high in poultry of all ages. In

growing birds considerable quantities of Vitamin D are necessary to allow assimilation of necessary minerals, particularly calcium and phosphorus.

Symptoms.—In chicks the first evidence of D-avitaminosis appears as a leg weakness, in an inclination to rest on the hocks rather than to stand. Eventually the chicks may be unable to stand, the bones as well as the beak become abnormally soft, elastic and often crooked. The joints may be enlarged, and "beading" of the ribs is observed. Mature birds do not show such pronounced symptoms, but a lack of Vitamin D is manifested chiefly by the laying of thin-shelled eggs and finally production stops.

Infectious Coryza

Infectious coryza (roup, colds, contagious catarrh) is a highly infectious disease of chickens and other species of fowl, characterized by a catarrhal inflammation of the mucous membranes of the upper respiratory tract. The cause of infectious coryza has not been definitely determined. *Hemophilus gallinarum* seems to be invariably associated with certain types but is not present in all cases.

Symptoms.—The first symptom observed by the poultryman is that bits of litter and feathers stick to the beak and nostrils. The inflammation frequently extends to the eyes, causing a foamy lacrymation, and the eyelids stick together. The sinuses below the eyes become enlarged because of an accumulation of a pungent, cheesy material which eventually destroys the eye (Fig. 9). Sneezing and vigorous shaking of the head in an attempt to dislodge exudate, droopiness, inappetence and difficult respiration usually follow.

Fig. 9. Infectious Coryza.

Post-mortem Findings.—There are no lesions that are of diagnostic value. A thick mucopurulent exudate is present in the sinuses and respiratory passages. Yellowish diphtheritic patches may be found in the mouth and pharynx. These should not be confused with diphtheritic lesions, which adhere firmly to the mucous membrane, whereas those in infectious coryza do not.

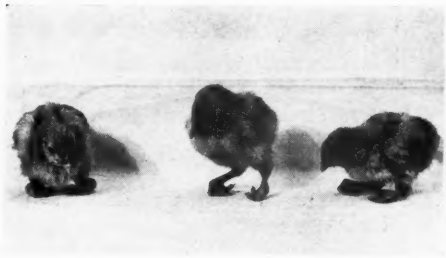

Fig. 10. Two-weeks-old chicks affected with malnutrition. Note the bent legs and the crumpled condition of the toes. Such chicks recover in an astonishingly short time if a balanced ration is supplied them. —*Photo by A. J. Durant.*

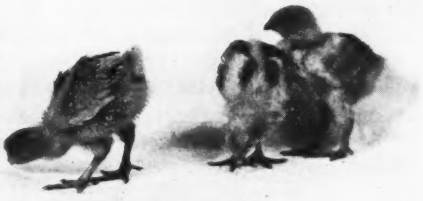

Fig. 11. The same chicks after they had been properly fed for five days. Note that the legs and toes have resumed a normal position and that all three chicks are able to stand in a correct position. Their recovery is complete.—*Photo by A. J. Durant.*

Aspergillosis

Aspergillosis (mycosis, pneumomycosis, brooder pneumonia) is a disease of the respiratory system of fowls. The infection is caused by *Aspergillus fumigatus,* which is found in moldy litter, grains and sour milk, birds of all ages being susceptible.

Symptoms.—The primary symptoms consist of accelerated breathing, a slight catarrh, fever, choking, sagging wings, inappetence and finally suffocation. The infection may be limited to a single bird or it may involve a large number.

Post-mortem Findings.—The lesions are generally confined to the respiratory tract, primarily the lungs and air sacs, but the infection may spread to other organs of the body. A yellow or gray caseated mass is usually found through these organs.

Diagnosis.—A positive diagnosis is dependent upon isolation and identification of the fungus. A wet mount examination of material treated with a 10% solution of sodium or potassium hydroxide will frequently reveal the fungus.

Sinusitis

Infectious sinusitis (swell head) is an infectious disease common in turkey flocks, in which the sinuses of the head become swollen and enlarged. The exact cause has not been determined.

Symptoms.—The disease is most commonly observed in poults over three months of age. Infection may be bilateral or unilateral. A nasal watery discharge is first observed. The eyes will contain a foamy secretion and if swelling of the infraorbital sinuses is extensive the eye may be completely closed. Upon palpation the distended sinus is soft and doughy, and contains a cloudy, mucoid exudate. In cases of long standing the exudate may become firm and caseated. Difficult respiration may occur if the nasal passage becomes plugged. The appetite of the bird appears normal as long as it can see to pick up food.

Post-mortem Findings.—The sinus may in the first stages be filled with a clear, gelatinous exudate, and in the later stage it becomes caseated and has a yellowish appearance. In some cases the air sacs and lungs may become involved.

Diagnosis.—Sinusitis due to A-avitaminosis and mechanical injury must be eliminated by history and post-mortem examination.

Internal Parasites

Birds are most commonly affected with two types of internal parasites, roundworms and tapeworms. The symptoms and lesions manifested by worm infestation are not constant and cannot be relied upon for diagnosis. The finding and identification of the causative parasite constitutes the only means of making an accurate diagnosis. The best procedure consists of opening the intestine and placing it in a shallow pan of water which permits the segments to float away from the intestine, thereby making them more easily observed. Several species of tapeworms are almost microscopic in size and may be seen only when the intestine is carefully examined.

* * * *

Vitamin A Deficiency

The chick fails to grow and has an unsteady gait. Usually there is swelling and watering of the eyes, and blister-like pustules in the throat. Post-mortem shows an accumulation of white deposits in the kidneys and kidney tubules. Feeding yellow corn in the ration is one of the most practical methods of preventing this deficiency. Vitamin A or its parent substance, carotene, is also present in green grass, alfalfa meal, and whole milk.—*Univ. of Wis. Agr. Exp. Sta. Bul.* 440.

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Curled Toes

This deformity is easily recognized, for the toes of one or both feet curl to one side. Growth is slow when the chicks are in this condition.

The trouble probably results from too low an intake of flavin, a vitamin of the B complex, and may occur when grains and their by-products make up too high a proportion of the diet. Protection is afforded by feeding some milk, meat scraps, or alfalfa meal.—*Univ. of Wis. Agr. Exp. Sta Bul.* 440.

Poultry Breeding Practices and the Control of Disease

By L. E. CARD, Urbana, Illinois
University of Illinois

FOR many years the practice of poultry breeders has been based on the assumption that "Like begets like." On the basis of this assumption it was perfectly logical to select as breeding stock those individuals which most nearly approached the ideal for which the breeder was working, and this was the procedure commonly followed.

L. E. Card

But the results were not always up to expectations. In fact, they were rarely so, and in time the more critical and observant breeders came to realize that the basic assumption was in error. If modified to read "Like begets like, but not just like," it more nearly corresponded with actual experience, particularly with reference to the easily observable physical or morphological characters. As knowledge of dominant and recessive characters became more general, more of the discrepancies were explained, but still too many cases failed to turn out as expected.

Not until the idea and the principle of the progeny test were generally accepted did we have anything like an accurate appraisal of breeding results. This principle has completely shifted the point of emphasis in the selection of breeding stock. The appearance or performance of an individual may still be of definite value, and of more than passing interest, but the important point in selection is rather "What will be the appearance or performance of the offspring which that individual produces?"

It is not enough to select and save the hens which have laid 250 or more eggs in their pullet year, or the sons of such hens. Much more valuable as breeders are the hens or the males whose daughters or sisters have been uniformly high producers. Males and females which produce highly fecund offspring can be depended upon, as a rule, to repeat the performance as long as their eggs will hatch. This means that the poultryman has an accurate measure of breeding value.

■ As the study of poultry breeding has expanded, we have learned that many physiological characters in the fowl are subject to the same general plan of inheritance as are the simple physical characters. Partly on the basis of established facts and partly from analogy, it seems entirely reasonable to conclude that the control of disease can be greatly aided by careful attention to selection of the breeding males and females.

It has been shown, for example, at the Illinois Agricultural Experiment Station[1] that certain chicks are highly resistant to inoculation with pure cultures of *Salmonella pullorum*, the causative agent of pullorum disease, while other chicks are highly susceptible. This simple finding is much less significant, however, than is the related fact that resistance and susceptibility are hereditary. Chicks hatched from resistant parents will be resistant and those from susceptible parents will be susceptible.

Not only this, but when resistant and susceptible stocks are crossed the resulting progeny are resistant. When these are mated among themselves to produce a second generation, both resistant and susceptible individuals occur, and these in turn can be segregated into two lines which are as resistant and as susceptible, respectively,

[1] Roberts, E. and L. E. Card, 1935. Inheritance of Resistance to Bacterial Infection in Animals. A Genetic Study of Pullorum Disease. Ill. Agr. Exp. Sta. Bul. 419:465-493.

as the original parents. Selection for resistance to pullorum disease, if based on the progeny test, i.e., inoculation of chicks to test the resistance of the parents, is definitely effective in establishing resistant lines.

Similar results have been secured at the Iowa Agricultural Experiment Station[2] in establishing strains which are resistant to fowl typhoid. Presumably there exist in certain stocks hereditary factors for resistance to other specific diseases, but the available evidence is rather limited.

■ In recent years there has been a discouraging record of increasing mortality among pullet flocks, whether these be in egg-laying contests, on experiment station plants, or on commercial poultry farms. Much of this mortality is the result of causes for which there is no known method of prevention or control in the pathological sense. Of course it is highly desirable that we find the specific causes and effective methods of control, but in the meantime there is definite hope of improvement through the avenue of selection and breeding for viability.

Encouraging results have already been secured at more than one experiment station and on several commercial breeding farms. Breeding from old hens and from males which are sons of old hens is a step in the right direction because no hen can become old without surviving exposure to a number of different infections. More effective selection can be made on the basis of family survival. A hen which has eight to 12 daughters all of which live through a full year of laying, when other pullets subjected to the same environment show death losses ranging up to 50% or higher, has the characteristics which it is desirable to perpetuate. Similar striking differences are often found between males when adequate pedigree records are kept.

That selection on a family basis can be effective is shown by results obtained at Pennsylvania State College and at Cornell University. Adult mortality in poultry flocks at the Pennsylvania State College was extremely high during the six-year period 1927-32[3]. This high mortality was due to various forms of the fowl paralysis complex and included iritis, paralysis and tumors. Following 1932 all breeding stock was selected on the basis of family viability, with egg production, egg size, body weight, and hatchability as secondary factors. During the five years of selection on this basis nearly 5,000 adult birds of two different breeds were placed in laying quarters for observation of viability on a family basis over a 365-day period. Management conditions and rations were uniform during this five-year period.

The laying flock mortality in White Leghorns decreased from 39.8% for the six-year average, 1927-32, to 20.1% in 1937. The corresponding decrease in Barred Plymouth Rocks was from 48.7% to 24.6%.

The percentage of families showing high viability has increased from year to year. These data indicate that losses from fowl paralysis can be decreased gradually by the use of breeding stock from families that show resistance to the disease, and by the use of hens in preference to pullets in the breeding flocks.

Results of three years of breeding to increase viability in White Leghorns at Cornell University[4] indicate the same general trend, and future results will be awaited with much interest.

Further recognition of the possibilities in controlling disease through breeding is definitely indicated in connection with the recently established regional poultry research laboratory at East Lansing, Michigan. A comprehensive study of the fowl paralysis problem has been undertaken from both the genetic and pathological angles. This parallel approach, using identical stocks, should eventually result in establishing

[2] Lambert, W. V. and C. W. Knox, 1932. Selection for Resistance to Fowl Typhoid in the Chicken with Reference to its Inheritance. Iowa Agr. Exp. Sta. Res. Bul., 216: 1-84.

[3] Marble, D. R., 1939. Results of Five Years of Selection for Viability in Poultry Flocks. Proc. 7th World's Poul. Cong., pp. 46-48.

[4] Hutt, F. B., 1939. Reduction of Mortality in Fowls by Breeding. Proc. 7th World's Poul. Cong., pp. 49-51.

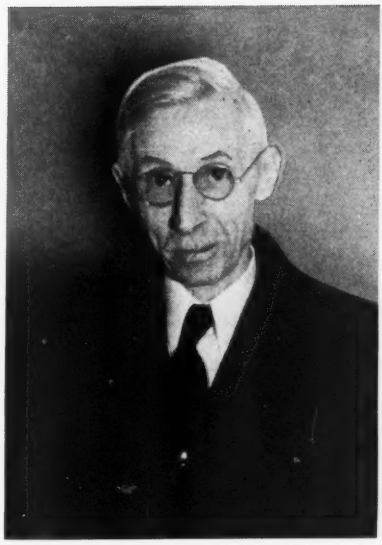
practical means of controlling this important disease.

■ Until such time as more definite information is available concerning the hereditary nature of resistance and susceptibility to specific diseases, breeding practices should include as a first step the use of older hens and sons of older hens as foundation stock. Wherever the necessary records are available, they should be used to identify as breeding males and females those individuals whose progeny have shown uniformly high resistance and survival.

Polyneuritis

The symptoms are failure to grow and a tendency of the neck muscles to undergo spasms which result in bending the head far back. This difficulty is caused by lack of sufficient vitamin B_1. Poultry rations usually contain enough of this factor if air-dried grains are used, but since heat destroys the vitamin, kiln-dried grains may not be as good. Meat products and the germs of grains are rich in the anti-polyneuritis factor, while milk contains some of it.—*Univ. of Wis. Agr. Exp. Sta. Bul.* 440.

Hugh Frederick Dailey, 47, chief veterinarian of the Angell Memorial Animal Hospital of the Massachusetts S. P. C. A., Boston, died of a heart attack Oct. 29. Doctor Dailey was graduated from the School of Veterinary Medicine, University of Pennsylvania, in 1913, had been employed by the anticruelty society for almost 25 years, and was nationally known in humane and veterinary circles. He was a great lover of animals, which were his hobby, and often entertained his friends with bizarre specimens in his home. In the illustration he is shown examining a patient at the hospital, where he was responsible for the hospitalization of nearly 9,000 animals yearly and for the treatment of some 25,000 annually in the clinic. Doctor Dailey had been in poor health for several years. He is survived by his widow, three daughters, five sisters and a brother.



Robert Alexander Craig, 67, professor of veterinary science, Purdue University, Lafayette, Ind., was accidentally killed Oct. 11 when struck by a motorcycle on a street crossing near the University. Doctor Craig was graduated from the Veterinary Division of the Iowa State College in 1897 and had been on the faculty of Purdue 40 years. He was the author of a number of bulletins on sheep and swine diseases and of two veterinary textbooks. He is survived by a son and three grandchildren.

Swollen Gizzard Linings

This difficulty can easily be confused with gizzard lesions, and like the latter it induces slow growth. The cause is quite different, however, for swollen gizzard linings are brought about by lack of sufficient coarse material in the ration. The practical remedy is to include from 1 to 2% of granite, flint, or other insoluble grit in the ration. If care is taken to have the grain coarsely ground, it may not be necessary to use insoluble grit.—*Univ. of Wis. Agr. Exp. Sta. Bul.* 440.

Poultry Flock Sanitation

By W. W. THOMPSON, Manhattan, Kans.
Department of Veterinary Pathology, Kansas State College

THE ultimate aim of every veterinarian should be to have every poultry client managing his flock on a definite plan of farm sanitation. This would mean a considerable reduction in the millions of dollars annually that disease costs the American poultry industry.

■ The veterinarian's success in instituting a plan of sanitation on any given farm will depend largely upon the following considerations:

1. The plan must embody all the sound principles of sanitation, but must be flexible enough to permit adjustment to the peculiarities of the physical equipment and type of management found on each individual farm.
2. This type of treatment cannot be prescribed from an office chair. The veterinarian must get out on the farm and study the complete layout in detail and then present the client with a well-formulated, practical plan of procedure and be prepared to show him how to put it into operation.
3. The veterinarian must be a good salesman and understand the psychology of sales resistance. For example, the plunger type of individual or one sorely pressed by disease losses, could be convinced of making complete and radical changes in one grand sweeping movement. On the other hand, the conservative type, or the man who is having little or no trouble, but who needs to institute a program for future protection, will have to be carried along and induced to make changes a step at a time until the program is brought into complete operation.
4. Once a plan of sanitation is put into effect frequent check-ups will be found necessary in order that the client may be given information on new questions that arise, have his mistakes corrected and be encouraged to keep up the good work. These check-ups should be made at least once a month.
5. In discussing sanitation with his client the veterinarian must use the phrases "disease eradication" and "disease prevention" with a great deal of care. To the average layman these terms mean the establishment of an almost sterile environment and the complete abolishment of all diseases. The client should be impressed with the fact that the aim of these control measures is to reduce and hold to a reasonable minimum the number of disease-producing organisms with which the birds may come in contact.

■ Poultry farm sanitation starts with the soil upon which the plant is to be located. One must consider the soil type, natural drainage and topography. The more air and the less moisture a soil contains the more unfavorable it becomes as a medium in which pathogenic microbes and parasitic larvæ can survive. The ideal location is on a rather light, sandy type of soil located on an area that slopes gently toward the south. This combination gives a soil that is porous, well aërated and with little tendency to hold water. The slope aids drainage and helps prevent pools of surface water. The southern exposure permits a maximum amount of sunlight to reach the area and conduces to prompt drying after rains.

The least desirable situation is on a heavy clay soil lying flat or in the bottom of a narrow valley. This type of soil has a very marked tendency to hold water; it is poorly aërated; the narrow valley receives a minimum of sunshine and air movement and hence the damp, heavy soil becomes an excellent medium for the survival of the pathogens.

Poultry plants will be found on all types of locations ranging from the most ideal to the least desirable. One will seldom find it convenient or practical to make a complete relocation of a plant that is not desirably located. When conditions are not hopelessly bad, measures such as providing artificial drainage and filling low spots where surface water tends to accumulate can be resorted to as means of improvement. Where conditions are hopelessly beyond improvement, complete relocation on a more desirable site may be the only practical solution of the problem.

The question of shade on the area used for poultry is one of importance. Some

shade is of course desirable, but too much natural shade will, by cutting out sunlight and tending to keep the ground moist, help to create an area favorable to contamination. The desirable arrangement is to have a tree windbreak on the north and west sides and then provide shade by means of portable sunshades which can be moved to a new location before the ground beneath them becomes dirty, damp, and dangerous.

■ The poultry housing equipment on the average is of three types: laying houses, brooder houses, and range shelters. The brooder houses can be and often are used to shelter the growing stock on the range. Laying houses, because of their size, must be permanently located. The brooder houses and range shelters should be of the portable type.

While large, permanent brooder houses have been and are still in use on many large poultry farms, they have proved in general to be far from satisfactory. Any advantage of this type of house over the small, portable kind is more than offset by the difficulty involved in keeping the permanent house sanitary and the great danger of keeping large numbers of chicks in close contact during the most susceptible period of their lives. The portable brooder house requires a little more effort in the routine care of the chicks, but it possesses several advantages in that it can be easily moved to new, clean ground; it is not difficult to clean; and any outbreak of disease within a house unit of chicks can, by quarantine measures and the use of a little care, be limited to that one unit.

Sanitation cannot be maintained in poultry houses that do not meet climatic requirements, are not properly constructed, are difficult to clean, are poorly ventilated, and are too small for the number of birds housed in them.

Plans of poultry houses designed to meet the climatic requirements of different states can be obtained from the state college or state experiment station. These plans can often be used as a guide in the remodeling of the not wholly satisfactory building already available. Plain, substantial construction with freedom from cracks and from built-in features of unproved worth, hard to clean and capable of furnishing hiding places for external parasites, is the ideal from the standpoint of sanitation. A frame building, properly insulated against extremes of temperature, is generally considered the best, but other building materials can be used provided the construction work is properly done.

■ Many otherwise acceptable poultry houses are rendered insanitary and dangerous because of faulty floors and ventilating systems. The flooring materials used most commonly are dirt, wood, and concrete. While dirt floors are the least desirable, they can, if properly prepared and cared for, be made to serve in a quite satisfactory and sanitary manner. The first step in the preparation of the dirt floor is to have a foundation for the building that is at its lowest point at least one foot above the ground level. A layer of several inches of crushed rock or coarse gravel should be spread over the ground within the walls of the foundation and then several inches of light sandy soil placed on top of this. The coarse material in the bottom will prevent water working up through from the ground, and the sandy soil will readily drain water spilled on from the top. Each time the litter is changed all filth should be removed from the surface, holes filled in with fresh dirt and the floor leveled off. Each fall when the house is given its general overhauling and cleaning, in preparation for the incoming pullets, about six or eight inches of the top dirt of the floor should be dug out, hauled away from the poultry area and replaced with fresh dirt from a location that has not been used for poultry range.

Board floors are quite satisfactory, if they are of tight construction and free of cracks in which dirt can accumulate. Such floors must receive good care and not be allowed to become broken up and worn out. Wood floors are the most desirable type for portable brooder houses and range shelters.

In spite of the fact that they are often

accused of being cold and damp, a smooth, well-made concrete floor is the most easily cleaned and hence the most sanitary type of floor for laying houses or any permanent poultry building. There are two reasons for the dampness of concrete floors; one is moisture coming up from the soil beneath them and the other is failure of the ventilating system to carry off the moisture in the air above them. The former can be prevented by laying the floor over a layer of coarse material as recommended for the dirt floor. An efficient ventilating system and refraining from overcrowding will overcome the second cause of dampness. To aid in the ease and efficiency of cleaning concrete floors, each pen should be provided with a workable drain towards which all areas of the floor have a gradual slope.

■ An efficient ventilating system must do two things of equal importance. It must admit a sufficient quantity of fresh air to supply the oxygen requirements of the birds, and it must carry off the carbon dioxide and moisture of the expired air. There are many types of ventilating systems for poultry houses, ranging from the simple but effective straw loft to the most complicated commercial contrivances.

For the average poultry plant the less complicated types that do not have mechanical parts which are likely to wear out or to get out of adjustment are the most desirable. The straw loft has met with wide favor. When the house is sufficiently equipped with windows and the loft is properly constructed one has an excellent, inexpensive system that needs little attention other than adjusting the windows to take care of weather changes and changing the straw once in two or three years. The greatest objection to this type of house is that sparrows and rodents are likely to infest it. This trouble can be overcome by screening the gable openings against the birds and using a wire beneath the straw with a small enough mesh to exclude rats and mice.

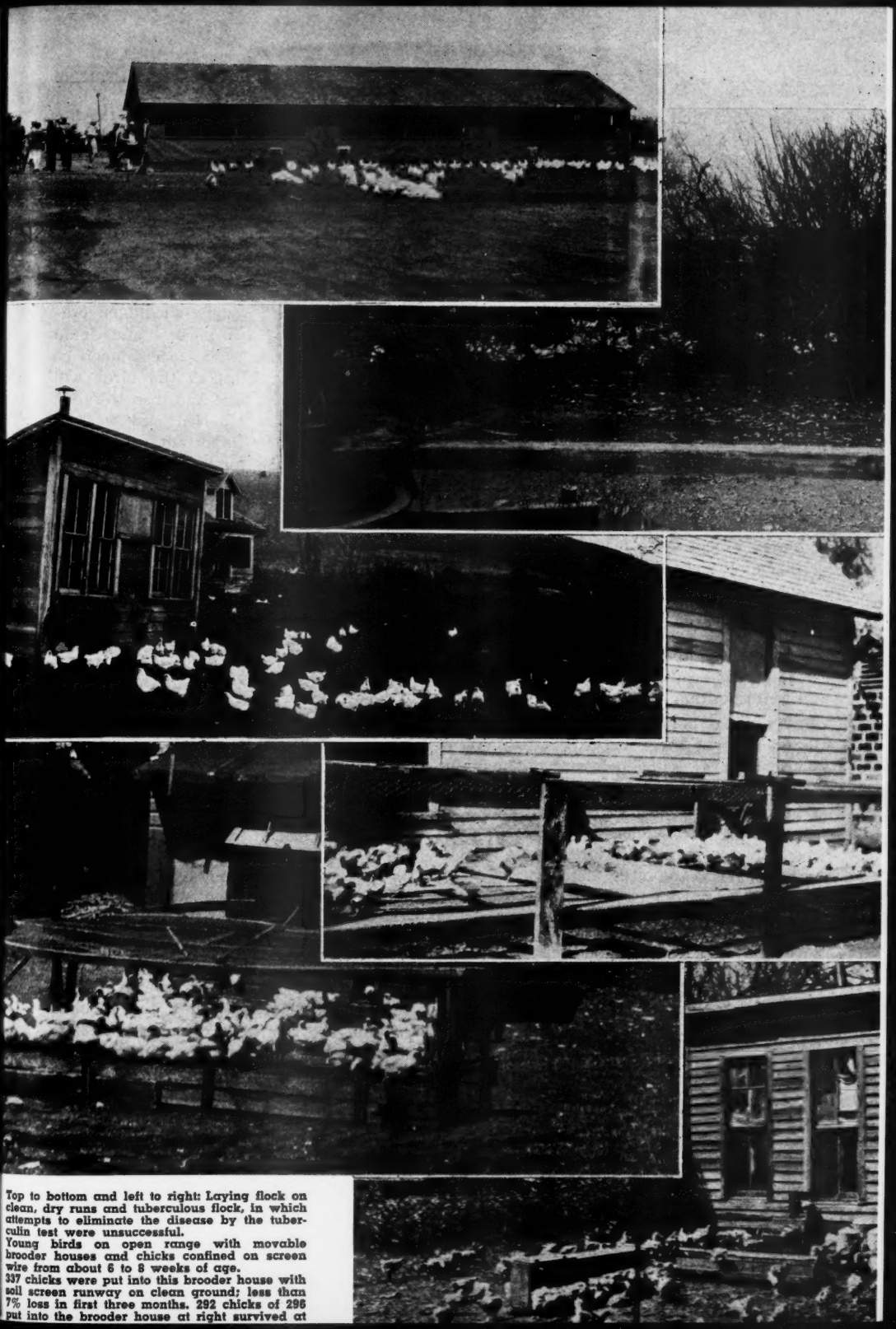
One common cause of failure in ventilating systems is the interference to outside air currents by closely adjacent buildings and high ground. With the stack or flue types this trouble can often be eliminated by raising the tops of the stacks above the obstructions, but with the loft type the only means of correction is to place the house away from such obstructions.

In the large multiple-deck houses and in battery plants, ventilation is one of the greatest problems. The veterinarian will, no doubt, be able to detect faulty ventilation by noting either too dry or too humid an atmosphere; but he will save his client money and himself worry by recommending the consultation of a ventilating engineer, rather than attempting to advise corrections in the system himself.

■ The dropping boards and perches should receive careful consideration. Dropping boards should be about three feet above the floor. They should be of substantial construction and the deck should be tight and easily cleaned. Tongue and groove flooring of good grade should be used for the deck and if the boards run from front to back rather than from end to end they fit together tighter, are less apt to warp, and there are no ridges to interfere when the droppings are scraped off.

The perches should be placed about one foot above the dropping boards and fastened to the rear wall with hinges, so that they can be swung upward out of the way when the dropping boards are being cleaned. The perches should be constructed of material strong enough to support the weight of the birds; two-by-twos are very satisfactory. It is important that a sufficient amount of perching space be available. One should allow one foot of perch for each bird, and the perches should be placed from 12 to 14 inches apart. The top surface of the perches should be rounded off on the edges so that the birds can grip them more easily and there will be no sharp edges to bruise the pads of the feet and toes.

A screening of some kind should be placed between the perches and the dropping boards to keep the birds away from the droppings. Hardware cloth or poultry net-



Top to bottom and left to right: Laying flock on clean, dry runs and tuberculous flock, in which attempts to eliminate the disease by the tuberculin test were unsuccessful.
Young birds on open range with movable brooder houses and chicks confined on screen wire from about 6 to 8 weeks of age.
337 chicks were put into this brooder house with soil screen runway on clean ground; less than 7% loss in first three months. 292 chicks of 296 put into the brooder house at right survived at

ting of one inch mesh serves very nicely for this purpose. Either of these materials will let the droppings fall through and their mesh is small enough to keep the birds from reaching through to pick at the droppings. It is a good idea to stretch the wire over frames that are small enough to be easily removed and scrubbed clean each time the dropping boards are cleaned. If they are allowed to become clogged with fecal material they fail to serve their purpose.

■ The equipment for handling feed consists of storage bins and feeding hoppers. The storage bins should be placed off the floors so that dirt is not swept into them and they are not wet by scrub water. They must be rodent proof, and should be provided with a hinged cover which is kept closed, except when feed is being put in or taken out. Feed storage bins should be used for no other purpose. One often finds them used as a storage space for brooms, forks, and shovels that are used for cleaning the poultry pens and as a temporary depository for live or dead birds while they await future disposition.

There are many types of feeding hoppers and most of them are satisfactory. There are, however, some points that should be kept in mind regarding them. They should be made so that they are convenient to clean. They should be placed high enough off the floor to prevent dirt being scratched into them by the birds. Some type of guard should be provided to keep the birds from getting into them and from perching on top of them. If metal or wooden strips are used as guards care should be taken to see that they are placed far enough apart to admit the birds' heads without injury. Sharp edges on these strips may cause severe injury to the birds' heads. Insufficient feeding space at the hoppers will promote fighting at feeding time and will prevent some birds from getting their share of food. One should allow at least six inches of hopper space for each bird. A very important point in poultry sanitation is to keep all food off the ground and pen floors. The practice of scattering grain in the litter to make the birds take exercise is now considered unnecessary. All feed should, therefore, be fed in the hoppers and some means taken to keep it there. A one-inch strip of wood or metal turned in along the top edge of the hopper will prevent the birds from billing the feed out onto the floor or ground.

Special pans or troughs should be provided for feeding wet mashes and liquid foods, such as milk. These foods should be fed in such quantities as the birds will clean up in a short time and then the containers should be removed and washed. This is particularly important with young stock on the range, for if these vessels are not cleaned they will attract flies and thus increase the danger of tapeworm infestation.

Feed bags that are returned to the mills and reused for poultry feeds become a potent source of spreading disease from farm to farm. Any flock owner who buys feed from local mills that do not use new bags for their feed should have his own bags and not accept feed in any others. These bags should be used for no other purpose and great care should be exercised in seeing that they are kept clean and uncontaminated.

The water supply should receive close attention. It should be adequate at all times and be provided in clean containers, that can be kept free of contamination. In cold weather some means should be provided to keep the water from becoming too cold or frozen. Poultry require as much water per pound of body weight as other types of live stock, or perhaps more, and if the chill is taken off the water in winter they are much more likely to drink the required amount. Provision should be made to keep the birds from having access to ground or floors that become damp from water that overflows or is splashed from the drinking pans or fountains. A platform for the water vessels, made by stretching hardware cloth over a frame of two-by-sixes, is a convenient method of keeping them away from such wet floors or ground.

■ Once the poultryman has acquired a suitable location, has his buildings in acceptable condition, and properly equipped, he must not be allowed to rest on these laurels. The battle is only half won, and the hardest part of it remains; he must now maintain the plant, in use, in as clean a condition as when it was new. The only method by which this can be accomplished is a regular process of periodic cleaning and scrubbing. As a prominent breeder once said in some literature which he sent out to his customers, "Sanitation consists of equal parts of lye solution and elbow grease applied vigorously with a brush at frequent intervals." This is particularly good advice because the average poultryman's idea of sanitation consists of the promiscuous spraying around of some foul-smelling disinfectant. Thorough cleanliness is the basis of sanitation and this can best be accomplished in all poultry buildings by first sweeping and scraping out all the dust and dirt that can be removed from all parts of the building and then scrubbing thoroughly with a lye solution made by adding one pound of concentrated lye to 15 gallons of cold water. Abundant use of the solution is necessary. When the scrubbing is completed the excess should be swept off and the surfaces thoroughly rinsed with clear water. For general clean-up purposes this is as cheap and as effective disinfection as can be desired. I do not mean to imply that disinfectants have no place in sanitation, but they serve their greatest use when a specific preparation is properly used against a specific organism. Furthermore, their proper use should not be trusted to unskilled persons. The veterinarian on the case should personally supervise the cleanup and disinfection of all buildings, yards, and equipment involved in a disease outbreak. To fail to do this is to be guilty of neglect of professional duties.

■ The successful control of poultry diseases on any plant will depend upon the use of a definite plan of sanitary management. Perhaps the most important step in any such plan is the absolute confinement of all poultry to those buildings and lands that have been set aside for their sole use. There are three good reasons for this arrangement:

1. Poultry sanitation cannot be maintained over the entire farm.

2. If birds are allowed the run of the farm there will be no uncontaminated place in which the healthy individuals can be placed should a disease outbreak occur.

3. Chickens running at large disseminate disease among other species of animals; we are continually uncovering evidence of diseases, heretofore thought to affect only poultry, being transmitted to other species of domestic live stock.

In outlining a plan for sanitary management the logical starting point is the incoming brood of chicks. The source of these chicks should receive careful consideration. They should come from vigorous stock that is known by history and by biological tests to be free from all diseases that are known to be transmitted from parents to offspring. They should be hatched in a hatchery that is clean and sanitary. If the veterinarian is consulted regarding the source of chicks he certainly should recommend those places that are using veterinary service in maintaining the sanitary standards in their flocks and hatcheries. (A few such places do exist.)

In preparation for the arrival of the chicks, the brooder houses and equipment should be thoroughly cleaned and disinfected and any needed repairs made. They should then be moved to clean ground that has not been used as poultry range for at least three years. Several days before the chicks arrive the houses should be supplied with clean, dry, short length litter. The heating equipment should be put into operation and adjusted to the proper temperature. Two thermometers should be used in the brooder house, one under the hover, at the edge and two inches above the floor, and the other on the wall. The heat should be regulated so that the temperature under the hover is about 105° F. and the ventilation should be adjusted so that the wall thermometer stays at about 70° F. The type of heater used will depend upon the kind

of fuel available, but if anything other than electricity is used it is very important to make sure that the unit is in perfect operation and that there are no traces of combustion odors in the brooder house. Combustion gases have caused severe losses in many broods of chicks.

A strip of low, small mesh poultry netting should be placed around the hover in a circular fashion to keep the chicks from getting too far away and piling up in the corners when they fail to find their way back to the heat. This wire should be placed out about two feet from the edge of the hover to allow room for the chicks to spread out when they want to cool off. After the first week the wire should be removed.

■ It is important to the health of growing chicks that they learn to use the perches as soon as possible, else when they are removed from the heat they will crowd into corners at night to keep warm. This soon becomes a habit and they will continue to crowd into corners the rest of their lives regardless of weather conditions and temperature. In these crowds birds are injured by trampling, their feathers become rough and dirty, and the birds become generally unthrifty. If small perches are placed in the brooder houses when the birds are about one week old they will soon learn to use them and the crowding difficulty will be avoided. Most good poultrymen like to have their birds perching when they are three to four weeks old. A satisfactory type of perch for chicks can be made by tacking hardware cloth over a light framework and then nailing perching strips, about one inch in cross section, on top of the hardware cloth. One edge of the panel is placed on the floor and the other edge is rested against the wall about eight inches above the floor. The ends should be enclosed to keep the chicks away from the droppings that accumulate beneath the perches. Each time the house is cleaned these panels should be removed and thoroughly scrubbed before they are replaced.

The age at which chicks are allowed to run out of doors will depend upon the time of year they are hatched and the climate. They should be allowed out just as soon as possible without being exposed to inclement weather and chilling.

The question of outside runs and their care is of great importance. Permanent runs for the growing stock should not be used unless the size of the premises makes it impossible to rotate the range from year to year. When permanent runs must be used they should be surfaced either with concrete or with several inches of coarse gravel that should be dug out and replaced with new gravel each year. Wire floored porches may be used but they absolutely must be made in sections that can be removed for frequent, thorough scrubbing and disinfection. Coccidial oöcysts are known to sporulate much better in small amounts of feces that catch on the wires of these floors than they do in massive accumulations of feces; therefore, if such floors do not receive close attention in regard to cleanliness they may become a potent source of danger.

■ When a sufficient acreage of suitable ground is available it will furnish a better location for growing stock. An area four times as large as that needed to supply range for the chicks of one year should be set aside for the purpose of employing a four year system of crop rotation in which a clover or alfalfa crop is used every fourth year as a range for the young birds. When the youngsters are old enough to be allowed out of doors they should be confined to an area adjoining the brooder house or range shelter by means of portable fences. These small areas should be only large enough to furnish a one week supply of green forage, at the end of which time the shelter and the fences are moved to a new area. The lowest parts of the range should be used first and the houses and pens moved up grade so that any contamination from previously occupied areas will be drained away from rather than onto ground that is being saved for future use. The fencing should always be placed on the side of the shelters opposite the direction in which they are being moved. This prevents the shelters being dragged over dirty

ground and carrying contamination onto the new location. By using this system of range conservation, clean range will always be available in case an outbreak of disease should occur. The practice of the four year rotation will allow time for the natural sterilization of each area by the time it is again needed for poultry range.

During the growing season the brooder houses and range shelters should be cleaned two or three times weekly and the droppings and soiled litter carefully collected and disposed of. All feeding and watering equipment should be cleaned daily. Special precautions should be taken to prevent adult birds from getting onto the chick range and to see that no contamination is carried from the old to the young on the feet or clothing of attendants or on tools and equipment. At the end of the growing season after the stock has been removed from the range all débris should be raked up and disposed of and all vegetation should be cut down and removed. The field should not be plowed in the fall, as this will cover up the contamination on the surface and protect it from the killing effect of the sun and elements.

■ The laying houses should be prepared well in advance for the pullets that are to come in from the growing range. The disposition to be made of the old hens will depend upon the management practices of the owner. Some sell the entire group while others prefer to keep the proved layers over for the second year or even longer if they are using the eggs for hatching. If the latter practice is used the old flock should be carefully culled and those that are retained should be concentrated in previously-cleaned pens or houses that are not to be used for pullets. Under no circumstances should the two ages be mixed. After the old hens have been removed from the houses the entire building, including feed rooms and all equipment, should receive a thorough cleaning and scrubbing with lye solution. They should then be opened up as much as possible, for exposure to the sunlight, until the pullets are brought in.

Before the pullets are brought in from the range they should be carefully culled and all birds that are not vigorous, normally developed, and showing promise of being producers should be marketed. These birds should never be used to help fill up the houses in the hope that they may later show improvement. It is more than likely that they will continue to fail, become susceptible to disease, and thus be a source of danger to the rest of the flock.

If the flock is to be tested for any disease now is a good time to do it, for reactors removed at this time will not be left to carry their infection into the laying house and thus a big step will have been taken toward breaking the disease cycle in the flock.

■ After the pullets are placed in the laying house they should continue to be kept under clean sanitary conditions by frequent, regular house cleaning and close attention to all details of sanitation. Birds that develop any signs of unthriftiness should be removed and the cause immediately determined by a post-mortem examination. Early detection of and prompt measures against disease are half the battle in preventing damaging flock losses.

Strict quarantine is an essential part of poultry sanitation. Visitors should be kept out of the houses and off the range. Sick birds, birds returning from shows, and new additions to the flock should be kept in complete isolation for at least three weeks. The presence of carriers among such birds can often be detected during the quarantine period by introducing three or four birds from the flock to which they are to be added. Quarantined birds should be released only on approval of the veterinarian.

Several years of experience in poultry disease work has convinced the author that sanitation is the one big factor in preventing disease losses in poultry. From experience in practice he knows that once the poultryman learns he can control disease in this way he is willing to put forth the extra effort and is just as willing to pay you well for your advice as he was to pay for something to put in the drinking water.

Anatomy of the Digestive Tract of Domestic Fowl

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THE descriptive anatomy of the fowl suffers because the writers draw too freely on their knowledge of the mammal. Consequently, statements have been made which are not supported by facts. In this brief discussion it is my purpose to call attention to a few of the inconsistencies and differences of opinion in connection with a brief description based primarily on the chicken. In English, Kaupp[1] has presented the most voluminous description of the chicken. Bradley's[2] work, brief and concise, devotes the major discussion to the digestive system. His illustrations of the histology are very good. Calhoun[3] has an excellent review of the literature on the digestive tract, a brief original discussion of the histology and an extensive group of photomicrographs. Grossman[4] has added 18 pages of poultry anatomy to the third edition of Sisson's Anatomy. Fleming's translation of Chauveau[5] includes considerable material on the fowl. In German, Ellenberger and Baum[6], van Heelsbergen[7] and Otto[8] have devoted more or less space to avian anatomy in their books. No attempt is being made to compare the work of these authors nor to mention various articles dealing only in part with the anatomy of the fowl.

Oropharynx

The absence of teeth, lips and extensive cheeks is well known. The mouth is a prehensile organ designed to pick up food. That of the chicken and turkey is designed to handle hard or solid food, seeds, grain and insects. (For this reason, special equipment is necessary to avoid loss in using mash feeds.) In the water fowl the long, broad bill serves especially well in separating food particles from water. The tongue conforms to the shape and size of the beak or bill. It is small, triangular and stiff in the chicken; larger, spatula-shaped and soft in water fowl. The range of movement, as a unit, is remarkable, due to the fact that the hyoid bone does not articulate with the skull. The posterior elements of this bone are cartilaginous and curve upward behind the base of the skull when the tongue is in the resting position. The existence of taste organs is both affirmed and denied. The consensus is that such nerve endings as are present, are probably concerned with touch rather than taste. They are especially numerous in water fowl.

A soft palate is entirely absent. Thus the cavity of the mouth and pharynx is continuous and may be conveniently termed the oropharynx. Its posterior extent reaches to the level of the third cervical vertebra. The usual statement, that the posterior limit of the pharynx is marked dorsally by a row of papillæ opposite the base of the occipital bone, appears to have been perpetuated by copying the error from previous descriptions. Dorsally the oropharynx presents the long, narrow choanæ and behind these a narrow median fissure leading posteriorly into a fossa containing the common opening of the Eustachian tubes. The choanæ are short, rather wide ovals in the duck and goose. Ventrally is the slit-like opening of the valvular cranial larynx. Several transverse rows of backward-pointing, horny papillæ cross the dorsal and ventral walls of the

[1] Kaupp, B. F., "The Anatomy of the Domestic Fowl."
[2] Bradley, O. C., "The Structure of the Fowl."
[3] Calhoun, M. Lois, 1933. The Microscopic Anatomy of the Digestive Tract of *Gallus Domesticus*. *Iowa State Journal of Science*, Vol. VII.
[4] Sisson, S., and J. D. Grossman, "The Anatomy of Domestic Animals," 3rd edition.
[5] Chauveau, A., "The Comparative Anatomy of Domestic Animals" (Fleming's translation).
[6] Ellenberger, W., and H. Baum, "Handbuck der Vergleichenden Anatomie der Haustiere." 16th edition.
[7] van Heelsbergen, T., "Handbuck der Geflugelkrankheiten und der Geflugelzucht."
[8] Otto, W., "The Diseases of Fowls with Particular Consideration of Anatomy and Hygiene." (Translation title.)

oropharynx. They appear to be mechanical aids in keeping food in the mouth during the act of swallowing.

Statements concerning the salivary glandular tissue are conflicting. Attempts have been made to name the masses of this tissue as in the mammal, but agreement has not been reached. Each mass of glands is provided with several ducts leading directly into the cavity of the oropharynx, an arrangement similar to that of the mammalian buccal glands. The salivary glandular tissue is abundant in the chicken. Its occurrence and distribution have not been adequately investigated in other species of fowl. It is probably most satisfactorily designated by its location. Thus we would distinguish palatine, lingual, buccal, pharyngeal and possibly mandibular or submaxillary masses of this tissue. The openings of many of the ducts are plainly visible, especially on the roof of the oropharynx. It is generally thought that bird saliva is entirely mechanical in function. However, Leasure and Link[9] in a recent study demonstrated the presence of a variety of enzymes in the saliva of the hen.

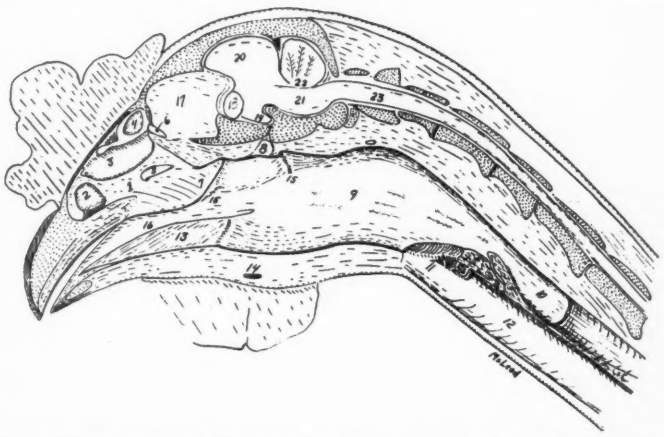

Fig. 1. Median section of the head and adjacent part of the neck. (Chicken.) 1. Nasal cavity. 2. Ventral turbinate. 3. Middle turbinate. 4. Dorsal turbinate. 5. Orifice of nasolacrymal duct. 6. Opening of infraorbital sinus. 7. Lateral wall of choana. 8. Entrance to Eustachian tubes. 9. Pharynx. 10. Esophagus. 11. Cavity of larynx. 12. Trachea. 13. Dorsal surface of the tongue. 14. Hyoid bone. 15. Rows of papillae. 16. Oral cavity. 17. Medial wall of orbit. 18. Optic nerve. 19. Pituitary body. 20. Cerebrum. 21. Medulla oblongata. 22. Cerebellum. 23. Spinal cord.

Esophagus and Crop

The esophagus begins in the median plane dorsal to the anterior part of the trachea, but soon passes to the right side of the neck and maintains this position to the entrance of the thorax. The thoracic portion passes obliquely from right to left above the heart, between the extrapulmonary portion of the bronchi and ventral to the pulmonary diaphragm. It does not touch the lungs. The cervical part is shorter than the corresponding part of the vertebral column since it cuts across first the concavity and then the convexity of the S-shaped cervical vertebral column. Thus the esophagus may be rended almost straight throughout its length by moderate traction on the head and neck. The crop (ingluvies) is a diverticulum from the ventral surface of the esophagus, lying slightly to the right of the median plane. It serves primarily for storage, compensating for the lack of capacity of the so-called stomach. Considerable softening and salivary digestion also take place in the crop. The size of the crop varies with the amount of its content. Its musculature is assisted by a specialized part of the cutaneous muscle, but may become atonic under conditions similar to those leading to atony of the rumen. In the duck and goose food storage is provided for by dilation of the esophagus rather than by a diverticulum.

The abdominal cavity is roughly oval in shape and varies considerably in capacity

[9] Leasure, E. E., and R. P. Link, The Saliva of the Hen. To be published in *Poultry Science*.

in the same individual. Accumulation of fat, limited almost exclusively to the posterior part, accounts for a considerable part of the variation. The remarkable size of the ovary and oviduct of the producing

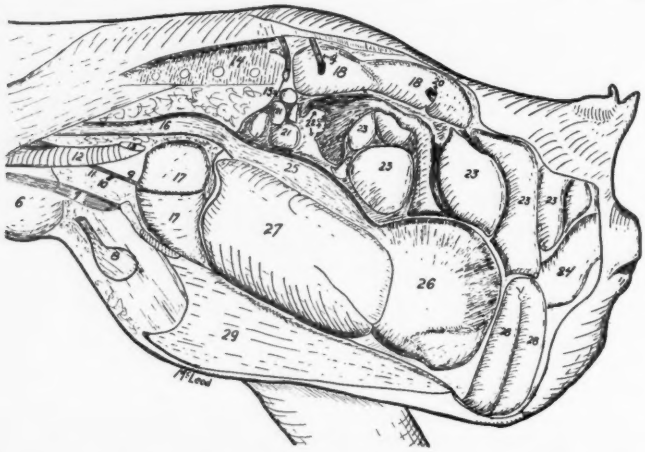

Fig. 2. Viscera of the female chicken, lateral view. 6. Crop. 7. Sternotracheal muscle. 8. Hypocleidium. 9. Brachiocephalic artery. 10. Brachial artery. 11. Carotid artery. 12. Syrinx. 13. Bronchus. 14. Ventral spine —thoracic vertebrae. 15. Thoracoabdominal diaphragm. 16. Esophagus. 17. Heart. 18. Kidney. 19. 7th rib. 20. Ischiatic artery and nerve. 21. Ovarian follicle. 22. Infundibulum. 23. Oviduct. 24. Colo-rectum. 25. Glandular stomach. 26. Muscular stomach. 27. Liver. 28. Duodenum. 29. Keel of sternum.

hen demands considerable increase in size of the cavity. The posterior process of the sternum invades the anterior two-thirds of the floor and is of importance in supporting the liver and muscular stomach. A thin aponeurotic sheet separates the abdominal and thoracic cavities. Its position is similar to that of the diaphragm of mammals, but it is entirely passive in function. The existence of this partition is doubted by some writers and denied by others. On purely anatomical grounds it is suggested that this partition be called the thoracoabdominal diaphragm to distinguish it from the functional pulmonary diaphragm covering the ventral surface of the lungs.

Stomach

That portion of the alimentary tract designated as the stomach only partially fulfills the classical definition for this organ, since its capacity is distinctly limited. One clearly recognizes glandular and muscular parts as separate and distinct organs in both shape and function. The fusiform glandular stomach lies in the dorsal part of the abdominal cavity to the left of the median plane and partly enclosed by the lobes of the liver. Its external size is not indicative of its capacity, since the walls are extremely thick and the lumen but little larger than that of the esophagus. The larger external diameter and the abrupt change in the character of the mucosa serve in determining the limits of the organ. A cross section presents a rather heavy mucosa, a thick glandular layer and thin muscular and serous coats. The glandular layer has a lobulated appearance. The center of each lobe is occupied by a macroscopic cavity communicating with the lumen of the organ by a duct opening on a low, wide papilla. According to Calhoun and others, large numbers of tubular glands open into these cavities in addition to those opening directly into the lumen of the organ. The lumen is almost always empty, suggesting that food does not remain in it any appreciable time. The character of the

glandular secretion has not received attention. Judging from the amount of glandular tissue, the quantity must be considerable.

The powerful muscular portion of the stomach is a mechanical aid to digestion. In function, it is virtually a substitute for teeth. It has the form of a flattened, biconvex disc with a muscular periphery and aponeurotic sides. The muscle is especially thick dorsally and ventrally, where the fibers are mostly transverse in direction. The direction of both the muscle fibers and the longitudinal folds of the lining membrane suggest that contraction reduces the dorso-ventral diameter of the organ. This is supported by fluoroscopic observations. The inlet is situated anterodorsally and to the left side. The outlet (pylorus?) is also on the anterior part of the organ slightly lower than the inlet and decidedly on the right surface. The lining is hard and rough. According to Calhoun and others, it is not a keratinized mucosa, but the coagulated secretion of the underlying glands. It is definitely of a protective nature. The muscular stomach of the duck and goose is smaller and weaker, and the mucosa is not so hard. This is in conformity with the character of the natural food of these animals.

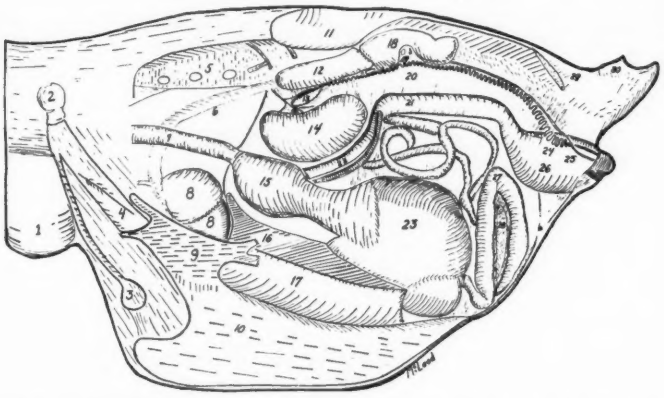

Fig. 3. Viscera of the male chicken, lateral view. 1. Crop. 2. Glenoid cavity—shoulder. 3. Hypocleidium. 4. Coracoid bone. 5. Ventral spine—thoracic vertebrae. 6. Aorta. 7. Esophagus. 8. Heart. 9. Sternum—body. 10. Keel of sternum. 11. Ilium. 12. Kidney, anterior lobe. 13. Epididymus. 14. Testicle. 15. Glandular stomach. 16. Liver, cut surface. 17. Liver. 18. Kidney, middle lobe. 19. Ischiatic artery and nerve. 20. Mesentery. 21. Large intestine. 22. Small intestine (cecum just below).23. Muscular stomach. 24. Ductus deferens. 25. Ureter. 26. Rectum. 27. Duodenal loop. 28. Pancreas. 29. Ilium. 30. Glandulae uropygii.

Small Intestine

The intestine is about five feet long, but, like that of the mammal, is subject to considerable variation. It is commonly divided into small and large parts, the origin of the ceca indicating the dividing point. Many writers fail to see any great difference in the size of the two parts. They probably examined birds with an empty, or nearly empty, digestive tract. Even a casual view of the chicken yard or dropping board should convince anyone that the terminal part of the intestine has considerable capacity and hence a potential diameter greater than that usually seen in the dead bird.

Approximately the first foot of the small intestine is arranged in a permanent, narrow, U-shaped loop, the limbs of which are less than a half inch apart. They are attached to each other by a fold of peritoneum with the pancreas enclosed between the layers. This part is known as the duodenum, although there is no histological justification for this name, since the part lacks the characteristic glands of the mammalian duodenum. Although only

the beginning and the termination of the loop are attached, its position appears to be as constant as that of the muscular stomach or of the liver. The loop passes backward along the right surface of the muscular stomach to the posterior part of the cavity, crosses the median plane to the left and turns upward. The apex of the loop lies near and to the right of the termination of the intestine. The second limb of the loop is always dorsal and ends along the anterodorsal part of the muscular stomach by turning dorsally into the great mesentery. The two bile ducts and two or three pancreatic ducts enter the bowel near the termination of the so-called duodenum. The mesenteric part of the intestine is attached to the dorsal wall of the abdominal cavity by the extensive great mesentery. It occupies the dorsal part of the cavity to the right of the median plane. Opinions differ as to the existence of jejunum and ileum. No part has the physical characteristics of the mammalian ileum, and this section is probably most satisfactorily designated as the mesenteric part of the small intestine. In young birds one finds a pointed process about midway on this part of the intestine, opposite the attachment of the mesentery. This represents the remnant of the yolk stalk. It slowly atrophies with age, but rarely disappears completely.

Colo-rectum

Except for the ceca, no agreement exists regarding the terminology to be applied to the large intestine. It has been called entirely colon, entirely rectum, and colon and rectum. It has a uniform structure. Functionally it serves as a reservoir for the accumulation of feces. This is also true of the terminal part of the mammalian colon when circumstances demand storage space beyond the capacity of the rectum. I prefer to call it colo-rectum and not attempt to make an artificial separation into colon and rectum. This part of the bowel is about four or five inches long and extends from the anterior part of the sublumbar region to the cloaca. It is attached dorsally by a mesentery and usually presents only very moderate curves or has a nearly straight course.

Ceca

The ceca are two blind tubes extending forward along the terminal part of the small intestine for a distance of from five to seven inches. They are attached to the intestine by peritoneal folds and are thus obliged to follow it through one or two rather abrupt curves. The ceca are small at their origin and for about a third of their length. The diameter here is so small and the wall so thick that one wonders that any intestinal content ever enters them. Beyond the constricted part their diameter is a half inch or more and the wall much thinner, especially near the blind extremity.

Cloaca

The cloaca is the cavity into which alimentary canal and the urinary and reproductive systems open. It is almost universally described as consisting of three parts: the coprodeum, into which the intestine opens; the urodeum, which receives the products of the urinary and genital systems; and a dorsal blind sac, the proctodeum. The terms are embryological and, except for the proctodeum, do not coincide with the facts. I have yet to find either a diagram or a photograph showing the relations and naming the portions mentioned above. It is true that the ureters and oviduct open into the same part of the cloaca, but the intestine opens into the same cavity and the male genital ducts do not. I offer the following description, upon which I invite comment.

The cloaca is a tubular cavity common to the alimentary, urinary, and reproductive systems. It is incompletely divided into an anterior, functional part and a posterior, non-functional part by a circular fold of mucous membrane. This fold is extensive dorsally but becomes progressively smaller when followed laterally and ventrally. The anterior portion is situated directly behind the termination of the intestine, from which it is separated by a valvular fold of mucosa containing a sphincter muscle.

The ureters open into the dorsolateral part of the pocket above the intestinal opening. On the left lateral wall, near the free mar-

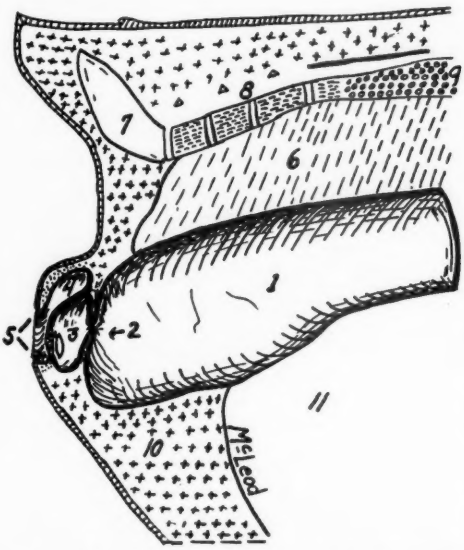

Fig. 4. Female cloaca and associated structures, median section. 1. Terminal part of large intestine. 2. Terminal valve of intestine. 3. Anterior pouch of the cloaca. Ureters open into dorsolateral part. Oval behind 3 is opening of the oviduct. 4. Dorsoposterior pouch of the cloaca. 5. External opening of cloaca. 6. Mesentery. 7. Pygostyle. 8. Coccygeal vertebrae. 9. Sacrum. 10. Fat.

gin of the fold, is the slit-like opening of the oviduct. The arrangement is identical in the male except that the genital ducts open on the apices of paired papillæ situated on the free border of the dorsal part of the dividing fold. The cavity of the posterior, non-functional portion is largely potential. The duct leading to the bursa cloaca (Fabricius) opens into the dorsal wall of this portion in the developing bird. At other times it is merely a blind pouch.

The bursa cloaca (Fabricius) is found only in growing birds. It is a blind sac extending upward from the dorsal wall of the cloaca and is limited dorsally by the coccygeal vertebræ. The maximum size is reached at four or five months of age, after which it atrophies rather rapidly. Lymphoid tissue comprises the bulk of the wall. The cavity is lined by mucous membrane continuous with that of the cloaca. Its function is unknown, but has been, and still is, the subject of much speculation. The fact that atrophy begins at about the onset of sexual maturity may be significant, but has yet to lead to any definite facts.

Digestive Glands

The size of the rather large liver varies with the amount and possibly with the character of the food intake. The largest glands are found in producing hens. Two principal lobes are readily recognized. Each is provided with a duct. These follow a parallel but independent course to the terminal part of the duodenum. Only the right duct has a gall bladder. The long, narrow pancreas, as mentioned above, lies between the limbs of the duodenal loop.

Definite lymph glands, as we know them in the mammal, are not present in the chicken. Much lymphoid tissue, in the form of isolated follicles, is present in the wall of the alimentary canal. Neither Calhoun nor Bradley were able to demonstrate aggregate nodules (Peyer's patches) such as are found in the mammal.

* * * *

The Importance of Nutrition

One by one the nutritional disturbances which attack growing chicks under confinement have been tracked down to their origin in lack of certain vitamins and minerals. Most of these discoveries have been found to apply to farm live stock and to mankind as well. Poultrymen had little need for detailed knowledge of nutrition as long as each year they raised only a relatively small number of chicks, mothered by hens which ranged the farm in search of insects, seeds, grit, and grass. But when changing times demanded early-hatched chicks, reared indoors in large numbers on prepared rations, then trouble began. Thousands of farmers have seen their chicks become sick or crippled, and finally die from nutritional causes.—*Univ. of Wis. Agr. Exp. Sta. Bul.* 440.

The Importance and Nature of Non-Specific

THE purpose of this paper is to report on the relative frequency of the occurrence in adult chickens of various types of pathological conditions unrelated to infection, parasitism or diseases of an otherwise specific nature, and to focus attention upon the significance of these non-specific diseases as causes of adult poultry mortality.

The material presented was obtained by the systematic autopsy of (1) all chickens over six months old that died or that were removed as culls from the flock of the Division of Poultry Husbandry, University of California (termed the "P. H. flock") during a period of four years[2] and (2) of all chickens of laying age that died on seven specialized poultry farms (termed the "farm flocks") during 19 consecutive months.

The deaths in the P. H. flock amounted to 1,164; the culls, 1,837. The latter included chickens in poor physical condition, those discarded because of unsatisfactory egg-production, and all surplus hens not needed for breeders or for nutrition experiments. Many of these surplus hens had good production records, were in perfect health and normal at autopsy, and would not have been removed from a privately-owned flock. They were, nevertheless, sacrificed for autopsy so that the pathological record of the flock would be complete.

The number of "farm flock" chickens autopsied was 4,770. These included all of the dead and a considerable number of culls which were not in salable condition. A much larger number, however, of chickens culled because of poor physical condition had some salvage value and were marketed. Consequently, the data on the farm flocks do not provide a picture of the disease situation as complete as that obtained for the P. H. flock.

[1] An abbreviated version of a paper presented at the 7th World's Poultry Congress, Cleveland, Ohio, August, 1939.

[2] A more detailed account of the data concerning this flock has been given by Lubbehusen and Beach (*J. A. V. M. A.*, 94:209-222, 1939).

Lymphomatosis and intestinal coccidiosis were the only specific disease conditions present in the P. H. flock. The incidence of the former was high in both the dead and the culls. The coccidial infection, however, never became widespread and was so effectively controlled by sanitation that it was a negligible disease factor. The flock was, and continues to be, otherwise free from all diseases related to infection or parasitism, a condition which makes it possible to evaluate more accurately the importance of pathological conditions of non-specific origin.

The specific diseases encountered most frequently in the farm flocks were lymphomatosis, infectious coryza and intestinal coccidiosis. Of lower incidence were infectious laryngotracheitis, fowl pox, and ascariasis.

Autopsy Procedure

The dead from the P. H. flock were brought to the laboratory so promptly that decomposition was rarely encountered. The culls were subjected to both ante- and post-mortem examination. For a considerable period, the inoculation of blood-agar slants with heart blood, liver and spleen was a routine procedure. The media so consistently remained sterile, however, that this practice was discontinued except for occasional cases with lesions of a nature suggestive of bacterial infection.

Generally, the diagnoses were made on the basis of the gross pathology, but all lymphomatous and other neoplastic conditions were identified by histopathological examinations. The pathological conditions which, because of their nature and magnitude, were believed capable of having caused death or, in the case of the culls, of ultimately causing death if the chicken had remained in the flock, were the only ones given consideration in this report.

The dead chickens of the farm flocks were picked up by the caretakers and immediately placed in a refrigerator, from which they were collected two or three

Pathological Conditions in Laying Chickens[1]

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times each week and taken for autopsy to an especially equipped building on one or the other of two farms. By this method of handling, decomposition before autopsy was almost entirely avoided. The facilities for autopsy provided for microscopic examination but not for further bacteriological studies. This deficiency was overcome by taking, from time to time, representative specimens to a nearby laboratory for culturing. In no instance was any infectious disease identified by the laboratory examinations which had not been detected by the autopsies on the farms.

TABLE I. AGE INCIDENCE AND DISTRIBUTION OF NON-SPECIFIC LESIONS IN THE 1,164 DEAD OF THE P. H. FLOCK

Age (Months)	Percentage of total deaths due to non-specific lesions*	Percentage of Total Non-Specific Lesions Present In			
		Alimentary System	Urinary System	Reproductive System	Miscellaneous Locations
7-12	31.8	34.7	14.5	26.6	24.0
13-18	71.7	22.6	19.6	45.0	12.7
19-24	70.0	21.7	32.0	32.9	13.2
More than 24	82.3	23.2	16.9	40.2	19.4
All ages	62.5	24.9	20.7	38.2	16.0

*Nearly all other deaths were caused by lymphomatosis.

Classification of Lesions

The non-specific disease conditions were originally classified according to the anatomical system to which the organs affected belonged, *i.e.*, the alimentary, including the liver and spleen; the urinary; the respiratory; the circulatory; and the reproductive. Lesions of other organs or systems were assigned to a miscellaneous group. However, since more than 80% of all lesions were of the alimentary, urinary or reproductive systems in the data presented, the lesions of all organs not a part of these three systems were placed in the miscellaneous group.

TABLE II. AGE INCIDENCE AND DISTRIBUTION OF NON-SPECIFIC LESIONS IN THE 1,837 CULLS OF THE P. H. FLOCK

Age (Months)	Percentage of total lesions* classed as non-specific	Percentage of Total Non-Specific Lesions Present In			
		Alimentary System	Urinary System	Reproductive System	Miscellaneous Locations
7-12	26.0	33.7	12.4	11.0	42.0
13-18	67.0	30.5	5.6	48.8	15.0
19-24	87.6	37.5	6.7	46.8	8.8
More than 24	92.0	27.0	5.0	54.0	14.0
All ages	59.8	33.0	7.3	41.1	18.4

*Account is taken only of lesions of such nature and location that they affected the health of the chicken or that probably would have caused death if the chicken had been left in the flock. Lesions were present in 1,009 of 1,837 culls. Nearly all lesions not classed as non-specific were lymphomatosis.

TABLE III. AGE INCIDENCE AND DISTRIBUTION OF NON-SPECIFIC LESIONS IN THE 4,770 DEAD OF THE FARM FLOCKS

Age (Months)	Percentage of total deaths due to non-specific lesions	Percentage of Total Non-Specific Lesions Present In			
		Alimentary System	Urinary System	Reproductive System	Miscellaneous Locations
5-12	44.8	48.0	14.9	19.1	17.9
13-24	51.2	28.6	21.0	33.6	16.7
More than 24	71.6	24.2	20.0	39.8	15.9
All ages	53.4	32.6	19.2	31.2	16.9

The Incidence of Non-Specific Disease

Non-specific disease in the P. H. flock was responsible for 62.5% of the total actual mortality, and 59.8% of the lesions present in the culls were of the non-specific type. Thus the combined actual and potential mortality due to non-specific disease amounts to 62.3% of the total deaths which actually did occur or which would have occurred if the culls had been left in the flock.

The non-specific disease conditions were of secondary importance during the age period of 7-12 months when the incidence of lymphomatosis was high, but in all older birds, 70% or more of the primary disease conditions were of non-specific origin.

In the farm flocks, non-specific pathological conditions accounted for the death

of 53.5% of the 4,770 chicks on which autopsies were performed. As with the P. H. flock, this type of pathology was less frequent in the younger birds and was increasingly prevalent as the age of the chickens increased.

Distribution of Non-Specific Lesions

As shown in tables I, II and III, the distribution of non-specific lesions in the anatomical system was similar for the P. H. flock dead and culls and the farm-flocks dead.

The alimentary system was the location of approximately one-fourth of the lesions in the dead of the P. H. flock and in one-third of P. H. culls and the dead of the farm flocks. The major pathological change in more than half of the dead was degeneration of the liver which, in many cases, had resulted in rupture of the organ and intra-abdominal hemorrhage. Other lesions of importance were enteritis and proventriculitis. In the farm flock birds, there was a high incidence of enteritis in the 5-12 months old group. This may have been related to the high incidence of intestinal coccidiosis on the farms, evidence of enteritis having remained after the parasites had disappeared.

Urinary system involvement consisted of derangement of the kidneys characterized principally by swelling and paleness of the organs, urate stasis and consequent distention of the tubules. It constituted approximately one-fifth of the non-specific lesions in the dead and a much less proportion of those in the culls.

Reproductive system involvement was the most frequent finding in both the dead and culls above the age of 12 months. The condition known as "ruptured yolk" with resultant peritonitis was the most frequent finding in the dead and a common, although not predominant, finding in the culls. Culture media inoculated from a number of these cases usually remained sterile, but several yielded a pure growth of *Escherichia coli*. The significance, if any, of the presence of this organism is not known. Other common findings were occlusion of the oviduct with caseated masses of egg material, salpingitis, and varying quantities of entire or crushed shell or soft-shell eggs in the abdominal cavity, the result apparently of reverse peristalsis of the oviduct. The latter was particularly common in cull chickens above the age of 12 months.

Summary and Discussion

These data, obtained by autopsy of approximately 7,000 chickens of laying age, more than two-thirds of which came from commercial poultry flocks, reveal that more than half of the deaths resulted from pathological conditions apparently unrelated to infection, parasitism, or other specific disease condition. Specific diseases, particularly lymphomatosis, intestinal coccidiosis and coryza, were predominant during the first laying year but thereafter such diseases assumed a place of relatively minor importance.

The autopsy of apparently healthy chickens culled from the P. H. flock because of unsatisfactory egg production records revealed that approximately one-third of them had pathological changes involving the reproductive organs, from which recovery was improbable and which were responsible for the chickens becoming poor producers. This is illustrative of the part which non-specific disease conditions may play in affecting egg production as well as the health of the chickens.

These non-specific pathological conditions should be recognized as constituting a serious poultry disease problem. Until we have some knowledge of the causative factors and remedial measures, poultrymen can be offered no method of prevention for more than half of the present heavy mortality among adult chickens. The acquisition of this much-needed knowledge will probably require the joint application of medical and other branches of biological science. Minor successes obtained by such a research program at the University of California make us hopeful of the future effectiveness of this method of approach to the problem.

Nutritional Diseases of Poultry

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IT IS impossible to draw any hard and fast line of demarcation between definite nutritional diseases in poultry and the more or less unthrifty conditions characterized by poor growth, poor feather development, low production, and low hatchability resulting from inadequate feeds. Strictly speaking, any abnormality, however slight, resulting from the use of a feed in which the essential nutrients are not present in the right amount or in the right ratio may be called a nutritional disease. As a general rule, however, such abnormalities are not so classified unless there are well-defined characteristic lesions which result from the lack of some specific essential nutrient. It is of little practical importance whether these conditions are called malnutrition or nutritional diseases. The important thing is for poultrymen to realize that it is impossible to produce vigorous, healthy poultry unless the feed used contains all the essential nutrients in proper amounts.

Fig. 1. Lack of vitamin B. These chicks represent two groups that were fed the same diet with the exception that chick on the right did not get the growth-promoting vitamin B. Note the contrast after feeding eleven days on the complete and deficient diets.

Practical experience, as well as the results of research, show that young growing grasses, especially cereal grasses, provide all the essential substances except Vitamin D. Poultry ranging on young grasses in the direct sunshine seldom show nutritional diseases. Where such range is not available, use of dehydrated grasses, handled in such a way as to prevent loss of vitamins, will insure a supply of the essential elements with the exception of Vitamin D, which can be supplied in the form of fish liver oil or irradiated yeast.

Fig. 2. Lack of antineuritic vitamin. Chicken from the group fed on the deficient diet suffering from polyneuritis. When given a treatment of an extract containing this vitamin, the bird will respond in 3 to 8 hours.

The following table is intended to indicate something of the problems involved in the preparation of a ration which will prevent the development of nutritional diseases, in commercial or other flocks where grasses are not available.

Substances Essential in an Adequate Diet	Some Sources of These Essential Substances	Some Effects of the Lack of These Essential Substances	Amounts of Essential Substances Required
OXYGEN	Air	Suffocation; failure of nerves and other tissues to function.	Good ventilation should be provided.
WATER	Water, milk. Some in nearly all feeds.	Thirst; non-functioning of body organs; low egg production.	Clean water should be available at all times.
PROTEINS (amino acids)	Meat scrap, fish meal, young grass from rich soil, alfalfa, soy bean oil meal, gluten meal, bran, and to a lesser extent, all grains.	Failure to grow and produce; loss of weight.	About 18% mixed proteins in mash for chicks for the first three weeks; scratch grain in increasing amounts as the chicks grow older. A well-balanced laying mash containing 18% protein fed at the rate of one part mash to two or three of grain.
CARBOHYDRATES Nitrogen-free extracts	Grains and their by-products, such as shorts and middlings, milk, tubers. Almost all feeds in greater or lesser amounts.	Lack of energy for growth and production.	Enough to provide energy for growth and production. All that the hens will consume when in heavy production.
Crude fiber	Coarser portions of plant materials.	Improper functioning of digestive tract.	
FAT	Small amounts in most feeds. (Meat and fish products with a high free fatty acid content are not desirable.)	Lack of energy.	Enough to provide energy for growth and production. All that the hens will consume when in heavy production.
MINERALS Sodium chloride	Meat scrap (traces); mineral mixtures.	Interference with the general functions of minerals: influencing contractability of muscles; determining irritability of nerves; regulating H_2O balance; regulating acidity. Interference with the specific functions of minerals: use in the formation of bones, egg shell, hemoglobin and an important factor in the coagulation of blood.	About 1%.
Calcium	Limestone, oyster shells, bone meal, meat scraps, mineral mixtures.		From 1.5% to 2%; enough to provide for a Ca/P ratio of about 2:1. For egg production, calcium carbonate *ad lib.*
Phosphorus	Bone meal, milk, cottonseed meal, bran shorts, grass and alfalfa grown on rich soil, mineral mixtures.		From 0.75% to 1%. High levels of phosphorus tend to cause perosis.
Manganese	Grass and alfalfa grown on rich soil; varying amounts in meat products and good mineral feeds.	Perosis (slipped tendon).	About 0.0035%. A maximum level of 600 p.p.m. has not proved toxic.
Other mineral elements	Grass and alfalfa grown on rich soil; varying amounts in meat products and good mineral feeds.	Unknown.	Insufficient information.
VITAMINS Vitamin A (A_1 and A_2)	Cod-liver oil. Egg yolk, butter and liver are fair sources if vitamin A potent feeds are fed to animals producing them.	Destruction of epithelial tissues, resulting in lowered resistance to infection and parasitism; low egg production; poor hatchability; destruction of nerves; ataxia.	Minimum for growing chicks, 150 I. U. per 100gm of feed, or 680 I. U. per pound. Minimum for egg production, 450 I. U. per 100gm (2,043 per pound). For optimum conditions greater amounts are desirable.
Provitamin A (carotenes and cryptoxanthin)	Green leaves (ordinary methods of making hay destroy most of the carotene); yellow tubers, fruits, yellow grains.	Same as Vitamin A.	
Xanthophylls (lutein) (zeaxanthin)	Green leaves. Corn.	Colorless fat, skin and egg yolk (these two pigments make up practically all the yellow color in the chicken body and egg yolk).	
Vitamin B_1 (thiamin)	Outer covering and germ of grains; yeast, young grass, alfalfa.	Increased nerve irritability; failure to grow; low egg production.	80 to 100mg per 100gm of ration. (Ordinary poultry rations are not deficient in this vitamin.)

Substances Essential in an Adequate Diet	Some Sources of These Essential Substances	Some Effects of the Lack of These Essential Substances	Amounts of Essential Substances Required
Vitamin C	All farm animals synthesize their own vitamin C.		
Vitamin D	Direct sunlight or light from ultra-violet lamps; fish oils; irradiated feeds.	Failure to utilize calcium and phosphorus; rickets, poor egg shell, low production and hatchability. Excessive amounts are toxic and lower production.	Adequate direct sunshine. Growing chicks receiving no sunlight require about 20 I. U. per 100gm of feed; laying hens, about 80 I. U.
Vitamin E	Grass, wheat germ oil. Considerable amounts are present in many feeds.	Sterility; there is some evidence that this vitamin is also necessary for the growing chick.	Not usually lacking in ordinary poultry rations.
Vitamin F (linoleic acid) (linolinic acid)		Abnormal skin condition.	
Vitamin B_2 (G) Complex Flavin	Young grass, fresh or dehydrated; alfalfa, fresh, dehydrated, or ordinary hay; milk, whey, liver, yeast, cottonseed meal, soy beans, Small amounts in many other feeds.	Stunting, low egg production, very low hatchability. Symptoms: (1) acute paralysis (neuromalacia) or (2) a chronic, "curled toe" paralysis.	Growing chicks: About 290 units per 100gm of feed. Laying hens: 130 units for egg production and 230 for good hatchability.
Vitamin B_6 (fraction 1)	Young grass, alfalfa, yeast, liver. Small amounts in other feeds.	Skin disorder in turkeys. Little is known concerning its function in chickens.	Undetermined.
Filtrate Fraction (Pantothenic Acid)	Young grass, alfalfa, liver, yeast, cane molasses.	Skin disorder, failure to grow, poor hatchability.	About 1.4mg per 100gm of feed.
Vitamin B_4	Vegetable oils.	Nervous disorder.	Undetermined.
Anti-gizzard Erosion Factor (chondroitin?)	Fresh or dehydrated grass, wheat bran; pork lung, liver and kidney tissue.	Disorder in gizzard lining of young chicks.	Undetermined.
Antihemorrhagic Factor	Young leaves, fresh or dried; pig, dog and beef liver; fish meal, alfalfa, kale, carrot tops, tomato, hemp seed, soy bean oil, egg yolk.	Hemorrhage in muscle and other tissues.	Undetermined.
Nicotinic Acid	Liver.	Slight and difficult to demonstrate.	Undetermined.
Factor W	Yeast, liver, rice, bran, wheat germ, milk.	Unknown. (Muscle dystrophy in rats.)	Undetermined.
Grass juice factor	Green grass.	Unknown. (Essential for nutrition of guinea pigs.)	Undetermined.
Lactation factors (vitamin L_1) (vitamin L_2)	Beef liver. Baker's yeast.	Unknown. (Essential for normal lactation in rats.)	Undetermined.

Tuberculosis of Chickens

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THE disease caused by the avian tubercle bacillus constitutes an entirely unnecessary economic burden on American agriculture. Although bovine tuberculosis was and is looked upon as a plague that must be suppressed, the disease in farm poultry is for the most part considered with more or less complacency. It is obvious, of course, that the importance of bovine tuberculosis and of avian tuberculosis is hardly comparable, yet there exist many sound reasons why the latter disease should not be tolerated by an enlightened husbandry. These reasons may be summarized briefly as follows: (1) unthriftiness of the affected birds; (2) the undesirability of tuberculous chickens for human food; (3) reduction or stoppage of egg production; (4) transmission of the disease to swine and to sheep, and (5) the sensitization of cattle to tuberculin.[1] A moment's reflection should make it apparent that the indictment against the tuberculous bird is serious. At least nothing has been offered to refute the fact that the tuberculous chicken is an undesirable member of the farm economy and as such should be eliminated. Unfortunately, the disease is probably on the increase, and we have as yet failed to formulate a comprehensive program that can be expected to eradicate it or even to bring it under satisfactory control. Surveys and educational propaganda are useful and important adjuvants, but it is fallacious to expect that any significant or permanent results will be achieved unless more aggressive tactics are insisted upon.

Incidence

Tuberculosis of chickens is worldwide in its distribution, although the disease occurs more frequently in the North Temperate Zone than elsewhere. In the United States the disease has been recognized since the beginning of the present century. Although it exists in practically all of the states there is a marked difference in its incidence in different parts of the country. The highest incidence of infection occurs in chickens of the North Central states, where probably more than 50% of the chicken population of the United States is found. The states in which the disease is most prevalent include North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Wisconsin, Illinois, Michigan, Indiana and Ohio. While no data are available as to what percentage of individual chickens in the states just mentioned are tuberculous, there are available figures that indicate that 50% to more than 60% of the flocks are diseased. The Southern states are relatively free from tuberculosis of chickens. The explanation for this is not entirely obvious, although there are several possible contributing factors, such as climate—the milder winters and the consequent greater periods of sunshine permit a longer outside existence than in the North—flock management, and duration of the infection. The maintenance of large flocks in the North and the practice of frequently acquiring new stock are probably important

[1] The evidence concerning the possible rôle of the avian tubercle bacillus in the sensitization of cattle to tuberculin has been presented by me in Avian Tuberculosis Infections (The Williams and Wilkins Co., 1938), p. 302; and The Rôle of the Avian Tubercle Bacillus in the Sensitization of Cattle to Tuberculin, *J. A. V. M. A.* 95:152-157 (Aug. 1939).

factors in the spread and continuation of the disease.

The impracticability of tuberculin testing all chickens in the United States or of testing even a majority of the flocks makes it impossible to obtain exact data on what the incidence of tuberculous infection of chickens really is. However, figures are available as a consequence of various surveys that indicate in a general way the extent of the infection. Information obtained from such sources indicates that the incidence of tuberculosis in poultry throughout the entire United States is probably between 5% and 6%. As mentioned previously, the incidence of the infection varies greatly in different sections of the country. In the North Central states, where the disease is most prevalent, a conservative estimate would place the percentage of flock infection between 50 and 65, while in the Southern states the percentage of infection is negligible. Infection varies greatly in individual flocks from less than 5% to as much as 95%.

The incidence of infection also depends upon the age of the chickens. This is strikingly illustrated by recent data kindly supplied by Prof. H. R. Smith.[2] Twenty-eight farm poultry flocks in one county in Illinois were tuberculin-tested, and 14, or 50% of the flocks were found to contain tuberculous birds. In these flocks the incidence of tuberculosis among a total of 1,476 hens more than one year of age, was 11.1%. In 1,056 pullets (under one year of age) in the same flocks the incidence of infection as determined by the tuberculin test was 0.19%.[3] This is not an exceptional observation and confirms the view that tuberculosis becomes more prevalent as the ages of the birds advance. There is evidence that indicates, however, that infection is less likely to succeed if exposure is delayed until the chickens reach maturity and that the disease when present in adult birds represents in most instances a process that began months or years before when the animal was young. Tuberculosis appears to be less prevalent in young fowl than in older birds, not because the younger birds are more resistant to infection than older birds but because in the older birds the disease has had a greater opportunity to become established as a consequence of a longer period of exposure.

Although the lesions of tuberculosis in the young chickens are usually less severe than the lesions in the adult, extensive or generalized tuberculosis in young chickens occasionally occurs. Such animals obviously constitute an important source of dissemination of virulent tubercle bacilli and must be considered a menace to other fowl and to susceptible mammals. That generalization of the disease does occur in young birds provides a formidable argument against the claim that avian tuberculosis can be eliminated by disposing of the older hens and maintaining a flock of young birds only. It is true that the concentration of potential infective material will eventually be diminished if only young birds constitute the flock, but the presence of even one pullet with lesions along the intestinal tract will provide an adequate source of tubercle bacilli to insure the continuance of the disease.

Since swine are readily infected with avian tubercle bacilli the importance of this phase of the problem should be emphasized. With the source of bovine tubercle bacilli all but eliminated[4] the statement that "on the average one out of eleven hogs slaughtered under Federal inspection in the United States is retained for tuberculosis"[5] may seem incredible. A study of the reports of the Federal Meat Inspection Service fails to disclose any degree of parallelism between the incidence of bovine and swine tuberculosis. The failure of the elimination of tuberculosis of cattle to re-

[2] Livestock Commissioner, National Livestock Exchange, Chicago.

[3] Hays found among 40,073 chickens tested in Nebraska that the incidence of tuberculosis was 9.3%. When the tuberculous birds were considered in relation to the different age groups it was found that 77.6% of the infected were more than one year of age and 22.4% were one year of age or less. (Hays, C. H., 1929. Avian Tuberculosis in Nebraska. *J. A. V. M. A.* 75:549-562.)

[4] At present (1939) with the exception of a few counties in California the proportion of cattle affected with bovine tuberculosis in the United States is less than 0.5%.

[5] Smith, H. R., 1938. Annual Report to the Sanitary Committee of the National Live Stock Exchange on the Eradication of Tuberculosis in Livestock.

sult in a satisfactory reduction of the incidence of tuberculosis in swine can be explained only by the fact that at present the vast proportion of tuberculosis of swine is due to infection derived either directly or indirectly from tuberculous chickens.

As may be noted in Table I, the incidence of tuberculosis in swine subjected to post-mortem examination by the Federal Meat Inspection Service during the year 1938 varied in 11 different cities from a little less than 5% to nearly 15%. The figures revealed a significant correlation between the areas where the incidence of tuberculosis of fowl is highest and the areas from which the greatest number of affected swine presumably originated.

TABLE I.—Incidence of Tuberculosis of Swine Slaughtered in Federally Supervised Abattoirs in Eleven Different Cities During the Year 1938*

City	Percentage of infection
South St. Paul	14.77
Detroit	13.6
Chicago	11.35
Cleveland	10.5
Sioux City	9.02
Omaha	7.99
South St. Joseph	7.5
Denver	6.4
Cincinnati	5.8
Kansas City	4.8
St. Louis	4.8

*Data supplied by Smith.

The fallacy of expecting tuberculosis of swine to disappear with the elimination of the disease in cattle is obvious. The disease will remain an economic burden on swine husbandry until it is fully realized that hogs will continue to become infected just so long as the disease is tolerated in chickens and other farmyard poultry.[6]

Source of Infection

In most instances the presence of tuberculosis in a farm flock can be explained by the fact that the flock is maintained in an unhygienic environment where infected birds have been kept for many years previously. Of course the introduction of new adult stock from sources where tuberculosis exists is a hazardous procedure and may be the means of transmitting the disease to a previously healthy flock. When new flocks are to be established from sources other than hatcheries, it is exceedingly important that the new stock be from sources where it is definitely known that tuberculosis does not exist. Chicks hatched from eggs laid by hens naturally infected with tuberculosis are believed by some to constitute a factor in the transmission of the disease. However, at present there is no convincing evidence that tuberculosis is likely to be introduced into a flock in this manner. In other words, baby chicks, regardless of their maternal source, if reared in an environment free from tubercle bacilli, are unlikely to become tuberculous.

Symptoms

In attempting to recognize tuberculosis in the living bird it should be borne in mind that but few symptoms of the disease are necessarily characteristic. From a practical point of view probably the most expedient way of diagnosing the disease with certainty is by post-mortem examination. The lesions are fairly characteristic and not likely to be confused with other pathologic conditions. However, tuberculous fowl do manifest symptoms that when considered with other factors constitute presumptive evidence of the disease. It is seldom that any one infected bird will present all of the symptoms that have been considered indicative of infection, but if the disease be at all prevalent in a flock, several or all of the symptoms may be evident in different birds.

Since tuberculosis usually has a protracted course, the disease is more likely to be detected during life by careful and repeated examinations than by a single cursory inspection. Objective signs are absent in the early stages of the disease and it is usually not possible to diagnose the malady at that time unless resort be had to the tuberculin test. Ordinarily, if the disease has progressed sufficiently to affect the physical condition of the bird, the animal will be less lively than its mates. If the disease be in an advanced state the affected fowl becomes fatigued easily and appears depressed or languid. Although the

*A detailed discussion of tuberculosis of swine due to avian tubercle bacilli will be found in my monograph, Avian Tuberculosis Infections (see footnote 1).

appetite remains good there commonly occurs a progressive and striking loss of weight which often amounts to emaciation. The thinness of the tuberculous bird is especially noticeable in the muscles of the

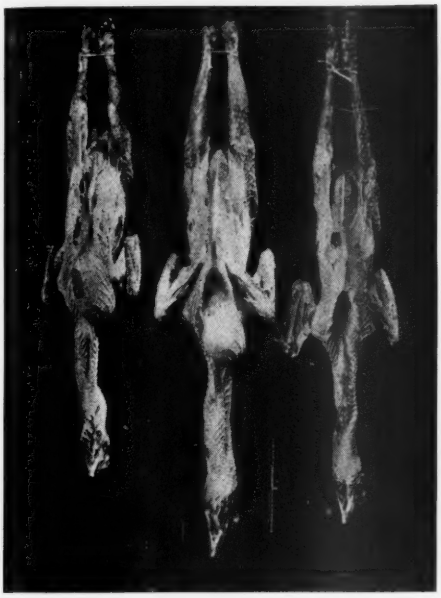

Fig. 1. Three naturally infected tuberculous chickens. Note emaciation evidenced by the prominent keel bone.

breast. The pectoral muscles are often in a state of complete atrophy and as a consequence the keel or breast bone becomes strikingly prominent and may be deformed (Fig. 1). In extreme instances most of the body fat eventually disappears and the face of the affected bird appears smaller than it would normally.

As the disease progresses the feathers assume a dull and ruffled appearance. The comb, wattles and ear lobes often become anemic and thinner than normal and the uncovered epidermis has a peculiar dryness. Occasionally the comb and wattles have a bluish discoloration. Icterus, indicative of hepatic changes, may be noted.

Unlike tuberculous infections in many of the mammals, the disease in chickens apparently does not induce a febrile state. Even though the disease be most severe the temperature of the affected bird remains within the normal range. In many instances the bird when forced to move reveals a unilateral lameness and walks with a peculiar jerky, hopping gait. This alteration of the gait, which appears to be characteristic, is probably due to tuberculous involvement of the bone marrow of the leg. Paralysis due to tuberculous arthritis sometimes occurs, but this is not a frequent symptom of the disease.

If the affected chicken be greatly emaciated one may detect nodular masses along the intestine by palpation of the abdomen. The great hypertrophy of the liver of many tuberculous birds may, however, make this procedure difficult or impossible. In about 10% of tuberculous chickens one may recognize the disease by palpation of the involved thymus glands. The crop should be empty if this procedure is to yield satisfactory results.

Most tuberculous chickens have lesions along the intestinal tract and if these be ulcerative, as they commonly are, a severe diarrhea, usually unmanageable, results. The enteric disturbance includes an extreme weakness and the affected bird assumes a sitting position as a result of exhaustion.

The duration of life of the tuberculous chicken is variable. Affected birds may die within a few months or may live for years. Death may occur from sheer exhaustion or the affected bird may die suddenly as a consequence of hemorrhage from rupture of the liver or spleen.

But few of the symptoms given are necessarily characteristic of tuberculosis. Convincing proof of a tuberculous infection can best be obtained by necropsy. In fact, the importance of necropsy for establishing a diagnosis of tuberculosis in chickens cannot be overemphasized. However, in districts where tuberculous poultry exist, the presence of the disease is suggested by: (1) unthriftiness; (2) progressive loss of flesh in spite of good appetite and (3) the chronicity of the symptoms.

Since the presence of tuberculosis does not preclude the coexistence of other dis-

eases, there are certain conditions that must be differentiated from tuberculosis. These include neoplasia, tapeworm infection, enterohepatitis, fowl typhoid and aspergillosis. From the standpoint of the pathologic findings two facts should be borne in mind in distinguishing tuberculosis from other conditions of chickens. These are: (1) the character and distribution of the lesions in the abdomen, and (2) the presence within the morbid tissues of numerous acid-fast bacilli. The latter are especially significant since they occur in no other spontaneous disease of chickens.

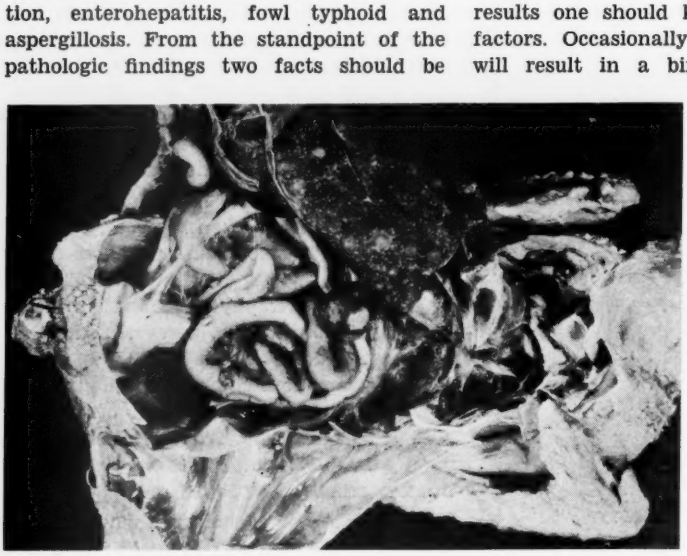

Fig. 2. Abdominal viscera of a naturally infected tuberculous chicken. Extensive lesions in the liver and the spleen with nodular lesions of the wall of the intestine.

The Tuberculin Test

The method of choice for determining the presence of tuberculosis in the living chicken is the intradermal tuberculin test, which was first applied successfully to chickens by Van Es and Schalk in 1914.[7] When it is administered properly and the results are interpreted with understanding, the tuberculin test provides a satisfactory procedure for determining whether or not tuberculosis is present in a given flock. The test is not infallible but in the hands of one competent to administer it the procedure offers an extremely valuable aid in the diagnosis and control of tuberculosis.[8]

Certain aspects of the test may occasion confusion to some and in interpreting the results one should keep in mind certain factors. Occasionally a negative reaction will result in a bird that is definitely tuberculous and, conversely, a positive result is sometimes obtained in chickens in which signs of tuberculosis cannot be demonstrated. In the latter instance, failure to find lesions of tuberculosis does not necessarily imply that tubercle bacilli are not present in the tissues of the chicken. If the disease is in an early stage, lesions are likely to be too small to be noted grossly or too few in number to be found by the ordinary methods of examination. In a satisfactorily large number of instances a definitely positive tuberculin test in chickens indicates that the bird has been exposed to avian tubercle bacilli. If a sufficiently diligent search be made by methods that are proper and adequate, the infective bacteria can usually be demonstrated in positive reactors.

Tuberculin is a bacteria-free substance prepared from the metabolic products of tubercle bacilli and as used for the diagnosis of tuberculosis in chickens may be considered entirely harmless to tuberculous as well as to normal birds. The question is frequently raised whether or not tuberculin injected into nontuberculous fowl may be

[7] Van Es, L., and A. F. Schalk, 1914. Avian Tuberculosis. North Dakota Agr. Exp. Sta. Bul. No. 108.

[8] The method of administering the tuberculin test and the interpretation of the results are considered fully in my monograph, Avian Tuberculosis Infections (see footnote 1).

responsible for a positive reaction on repetition of the test in the same bird. If retests are done after an interval of one month false positive reaction will not occur. In other words, in chickens the usual diagnostic dose of tuberculin does not sensitize the nontuberculous animal to subsequent injections of the same product.

The tuberculin test has been utilized to a limited extent in diagnosing tuberculosis of turkeys. However, for the most part the results have been less satisfactory than for chickens. Certain difficulties are encountered also in tuberculin testing of pigeons and ducks. Generally speaking, the test is of limited value in diagnosing tuberculosis in these animals.

Morbid Anatomy

If a proper understanding of the disease problem as it affects the chicken flock is to be obtained it is essential that a careful necropsy be made of all birds that die. Such an examination if conducted by one with a knowledge of disease will supply information that can be secured in no other way and will reveal the cause of death in a large percentage of instances. This is especially true in tuberculosis, where the signs of the disease are fairly characteristic.

The gross morbid changes associated with tuberculosis of chickens in fowl that have died of the disease are usually strikingly evident. If the bird has died suddenly, one frequently finds the abdomen filled with blood. The liver or spleen or both are greatly enlarged and the source of the blood can be traced to rupture of one of these organs. Since birds suffering from leucosis may die as a consequence of rupture of the spleen or liver, additional evidence of tuberculosis must be sought in instances where death was due to a fatal abdominal hemorrhage.

If the condition is due to tuberculosis, the characteristic lesions can usually be found. These consist of numerous yellowish-gray or flesh colored nodular masses of variable sizes in the liver and spleen and, somewhat less frequently, in the walls of the intestinal tract (Figs. 2-4). Such nodules are firmly embedded in the surrounding tissues but are not difficult to remove. When cut across, the larger nodules are found to consist of

Fig. 3. Tuberculosis of the liver and the spleen of a naturally infected chicken. For comparison there is included at the top a normal spleen.

a firm outer portion and a central region of soft, cheesy material having a yellowish tint. In the smaller nodules the soft material in the center is absent. Tuberculous nodules are commonly present in the lungs and are present in the marrow of the long bones in the vast majority of instances. Tuberculous lesions of the mucosa of the trachea not uncommonly occur (Fig. 5). Since the lesions of the trachea are usually ulcerated they constitute a fruitful source of tubercle bacilli which if eliminated into the food or water supply, may induce a tuberculous infection in susceptible species.

The excessively large number of tubercle bacilli present in the lesions of tuberculosis of fowl is one of the important characteristics of the disease. In this regard tuberculosis of chickens resembles two

Fig. 4. Segments of intestine of a naturally infected tuberculous chicken. There are numerous granulomatous nodules involving the wall of the intestine and miliary tubercles in the mesentery.

other mycobacterial diseases—leprosy and paratuberculosis (Johne's disease). The prodigious numbers of bacilli present in lesions and the marked tendency of the lesions along the intestinal tract to ulcerate and discharge a continuous stream of tubercle bacilli into the intestinal lumen provide an extremely favorable situation for the transmission of the disease. The infective fecal material of chickens with ulcerative tuberculous lesions of the intestine probably accounts for most of the dissemination of the disease from affected to nontuberculous animals. Discharges from the respiratory tract are also potential sources of infection, especially if the trachea be affected in addition to the lungs. Lesions of the liver and of the mucosa of the gallbladder not uncommonly eliminate bacilli into the lumen of the intestine by way of the common duct.

The continuous progressiveness of tuberculosis of chickens once the disease is established and the marked tendency of the disease to disseminate to several organs of the body indicate that tuberculous bacillemia is a common manifestation of the disease. That the blood stream of tuberculous fowl does at times contain virulent tubercle bacilli has been demonstrated repeatedly. This tendency of the bacilli to invade and circulate with the blood stream provides the explanation for the frequent involvement of the bone marrow of tuberculous fowl. Tuberculosis of the bone marrow of chickens is characterized by hypertrophy of the myeloid tissues, disappearance of most of the bony spicules and finally by the formation in the marrow of tuberculous nodules. The latter may be numerous and strikingly evident to the unaided eye, or the lesions may be few in number and of such size as to require the use of the microscope for their demonstration (Fig. 6).

Generally speaking, the morbid anatomy of tuberculosis of chickens is that of a serious, destructive, aggressive, granulomatous disease which seldom if ever heals spontaneously, and which in the great majority of instances eventually results in the death of the affected fowl. Treatment obviously is futile.

Control of the Disease

The eradication of avian tuberculosis or even its satisfactory control is not a simple matter. However, the widespread distribution of the disease, its high incidence in the more seriously infected areas and the increasing importance of the poultry industry make it imperative that adequate measures be devised for its control and ultimate suppression.

As in most other infectious diseases, vaccination for the prevention of avian tuberculosis has been considered and tried. The products used include the so-called Friedmann vaccine,[9] an avian strain of BCG, and heat-killed avian tubercle bacilli. The results obtained from any of these products would not justify the claim that avian tuberculosis as the disease occurs naturally can be controlled successfully by vaccina-

[9] Prepared from a so-called turtle strain of acid-fast bacilli (*Mycobacterium chelonei*).

tion. A measure of resistance can be conferred by the use of homologous strains, but much additional work will be necessary before vaccination can be accepted as worthy of serious consideration in the prevention of the disease.[10]

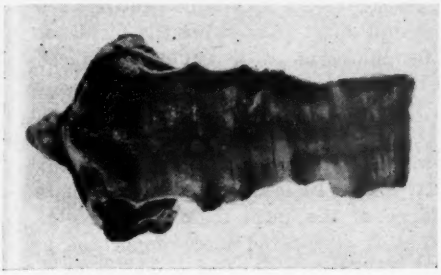

Fig. 5. Tuberculous tracheitis of a naturally infected chicken. The larynx has been opened to show the lesions on the mucosa.

The tuberculin test if used judiciously is of considerable value in reducing the losses from tuberculosis. The subsequent removal from the flock of those fowl that react eliminates many foci of infection. The test enables one to detect many infected fowl before the disease reaches a severe or chronic state and as a consequence potential dissemination of the infective bacteria to the surrounding environment may be appreciably reduced. However, this method if depended upon alone for combating avian tuberculosis has many shortcomings, the most important being that if the residual flock is permitted to occupy the same infective premises a rather constant source of infection remains. Avian tubercle bacilli may remain viable and virulent in soil for years. For this reason an environment once infected remains a potential source of infection indefinitely. Furthermore, neither the tuberculin test nor any other means can be depended upon with absolute certainty to detect every living tuberculous fowl; and as long as one infected bird remains in a flock, dissemination of the disease to healthy fowl is possible. Means other than the tuberculin test must be formulated if a satisfactory control of avian tuberculosis is to be expected.

[10] The question of vaccination against tuberculosis of chickens is reviewed in my monograph, Avian Tuberculosis Infections (see footnote 1).

For the past several years it has been generally stated that avian tuberculosis can be controlled if all birds in the flock be disposed of after the first laying season.

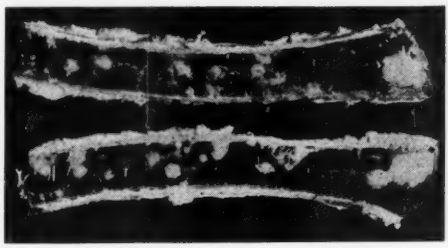

Fig. 6. Numerous tuberculous nodules in the myeloid tissue of the femur of a naturally infected chicken.

This practice has much to commend it, especially since it is economically sound from the point of view of egg production. Older birds usually produce fewer eggs than the younger ones and furthermore, the mortality from nonbacterial diseases such as neoplasia is greater among the older hens than among pullets. Another factor in favor of the disposal of the older stock is that if tuberculosis is present it is usually more severe in the older birds, which are as a consequence more likely to become depots of dissemination.

Desirable as it may be to dispose of the older birds, to maintain that such a practice will rid the flock of tuberculosis is at best an optimistic wish. Contrary to the belief of some, acute generalized tuberculosis occasionally occurs in pullets. The lesions in such a bird contain enough tubercle bacilli to infect a dozen flocks and if the carcass be eaten by its mates, the likelihood of several additional birds becoming infected is evident. To reiterate, the threat of avian tuberculosis in potentially serious proportions remains just so long as a single infected bird is a member of the flock. The removal of all birds after the first laying season is a practice not without merit, but that avian tuberculosis can be eliminated by this means remains to be demonstrated.

Since it has been adequately established that the continuation of tuberculosis in a flock is dependent upon an infected en-

vironment, it would seem reasonable to believe that this fundamental fact should be utilized in any program devised for the control and elimination of the infection. Basically the question is one of hygiene. That every case of tuberculosis comes from another case is aphorismic. After all, the disease is due to a well-known and definitely established cause—the tubercle bacillus—and this fact must not be lost sight of or ignored when measures to eliminate the infection are considered. To permit young birds, even though free from the disease, to range at will over premises that are infected or to occupy quarters that were used previously to maintain tuberculous birds, is to insure the continuation of the disease indefinitely.

Procedures for establishing and maintaining tuberculosis-free flocks should embrace the following: (1) Abandon the old equipment and establish other facilities on new soil that is known not to be contaminated with avian tubercle bacilli. Ordinarily it is impractical to render an infected environment satisfactorily safe by disinfection. (2) Provide proper fencing or other measures to prevent the unrestricted movement of the chickens, thus preventing exposure from previously infected premises. (3) Eliminate the old flock as soon as possible, burning the carcasses of birds that show lesions of tuberculosis. (4) Establish a new flock in the new environment from tuberculosis-free stock. If the chickens in such a flock are prevented from having access to an infected environment and are protected against accidental exposure to tubercle bacilli, it is reasonable to believe that they will remain free from tuberculosis.

The measures just mentioned for the elimination of avian tuberculosis are not complicated and should be applicable to most American farms. The additional profits that will accrue from a tuberculosis-free flock maintained in a hygienic environment will in time adequately compensate for the initial expense and work necessary to establish the new flock and new facilities. Furthermore, the general health of the birds will be better and losses from diseases other than tuberculosis will be better controlled. The benefits will also be reflected in a decrease in tuberculosis in swine. The importance of avian tuberculosis in the infection of swine is such that if chickens were maintained entirely separate and apart from swine the incidence of tuberculosis of swine would be reduced to a minimum.

Fundamentally, avian tuberculosis is a problem of the farm flock rather than a problem of hatcheries and large commercial flocks. In most instances the maintenance of the farm flock is incidental to what is considered more important agriculture. Other, and what is considered more valuable, live stock may be watched over with the greatest solicitude; yet the poultry flock continues year after year dependent for its well-being upon the caprice of a kindly providence or the vagaries of the poultry remedy vendor. Such a situation is ideal for the ravages of most diseases, especially those of a chronic, insidious character such as tuberculosis. Proper poultry husbandry embracing approved hygienic considerations will enable the flock owner to eliminate not only tuberculosis but many other infectious diseases as well.

Motion Picture on Fowl Tuberculosis

The manner in which a young farmer eradicated tuberculosis from his poultry and swine is shown pictorially in a motion picture prepared by the U. S. Department of Agriculture. The film is designed to portray the close relation between tuberculosis of poultry and swine.

The film, a revised version of an earlier picture, was prepared by specialists of the Bureau of Animal Industry and the motion picture technicians of the Extension Service. It is available in both 16 and 35 millimeter widths and requires approximately 23 minutes for projection.

Responsible organizations and individuals may obtain the use of the film on application to the U. S. Department of Agriculture, Washington, D. C.

Laryngotracheitis

By F. R. BEAUDETTE, New Brunswick, N. J.
New Jersey Agricultural Experiment Station

NOT so many years ago all diseases of the head and respiratory tract of poultry were commonly diagnosed as "roup." It was customary to recommend the usual sanitary measures and perhaps add some antiseptic to the drinking water. The so-called mixed infection bacterins were also employed. But regardless of the handling it is now evident that the disease stopped only because the susceptibles were exhausted, and not because of the efficacy of the treatment.

In the course of time several specific respiratory infections have been identified which have features in common, and a few specific but non-infectious diseases have also been identified; but these, too, might be confused with the infectious diseases. Now, since these diseases may be caused be viruses, bacteria, parasites, or deficient diets, it becomes evident that the use of the term "roup" is absurd. Moreover, it is equally absurd to expect any general recommendations to be effective. How could a bacterin possibly immunize against a virus disease; how could a virus vaccine immunize against a bacterial infection; or how could either product make up for a deficient ration or remove a parasite of the trachea? In other words, if one is dealing with a respiratory disease the first step is to make an etiological diagnosis.

■ Laryngotracheitis is one of the diseases of the respiratory group. Its cause is a filterable virus. It may affect chickens of any age and occasionally pheasants; other domestic species are naturally immune, and no other susceptible wild birds have been identified as yet. The virus enters the body by way of the respiratory tract and, so far as our tests show, remains there. Subcutaneous, intramuscular or oral inoculations do not produce the disease, but intravenous inoculation may do so occasionally. During the course of the disease the virus escapes by way of the respiratory tract and not by the digestive tract.

The course of laryngotracheitis is very definite, in contrast to the irregular course in most bacterial infections. The incubation period is less than 48 hours by experimental inoculation, and some birds may die in the first 24 hours after symptoms become apparent. From this point on mortality increases, but of the affected birds few die after showing symptoms for five days. In other words, by this time immunity has developed and the bird recovers rapidly. To be sure, when the disease spreads slowly the outbreak may last three or four weeks, but as far as the individual bird is concerned it is a matter of death or beginning recovery by the seventh day from the time of infection. A most important point is the fact that some birds which recover continue to carry the virus, presumably throughout life. The "carrier" is therefore the reservoir of infection for the annual outbreak.

The symptoms depend to some extent on the degree of infection, the part affected, the age of the bird and the season of the year. Text books usually describe the most common form of the disease and then mention the variations, but it seldom occurs to these writers that they are dealing only with the known cases. Actually, the largest number of outbreaks may be of such a mild character as to escape diagnosis. In any event, young chicks during the warmer months usually show mild respiratory symptoms and suffer a low mortality. On the other hand, birds under heavy production and during cold weather show alarming symptoms. The affected bird extends the head and neck and engages in a prolonged inspiratory act. The mouth is open and the eyes half-closed. Rattling, whistling or gurgling sounds are heard, depending on the nature and location of the exudate that provoked the respiratory embarrassment. A mobile fluid exudate is

usually associated with deep, rattling sounds, more viscid exudate provokes gurgling or cracking sounds, and a caseous plug causes a whistling sound. Obstruction of the tract leads to cyanosis of the comb in proportion to the degree of respiratory embarrassment.

Tracheal involvement is almost absent in some cases but the eyes, sinuses or nasal cavity may be affected. Here, the exudate is usually fluid at first and later collects in the eyes or cavities to form a caseous mass. All variations may be seen in the same outbreak. Obviously a bird showing a caseous mass in the conjunctival sac is quite different clinically from a bird whose trachea is filled with blood.

Death is caused by suffocation and the mortality is usually highest in birds under heavy production and in the colder months. Mortality may reach 70%.

On the basis of autopsy findings, a positive diagnosis can be made only when blood or bloody mucus is found in the trachea. An easily detached caseous plug in the larynx, or a croupous exudate in the trachea is fairly reliable evidence of this infection, but the presence of mucus only is common to too many respiratory infections to be of diagnostic value. Likewise, several diseases may cause the changes described in the eye, nasal cavity and sinuses. The internal organs of birds affected with laryngotracheitis show nothing of diagnostic value. The ovary may be highly congested and the lungs may show some congestion.

■ Differential diagnosis of respiratory diseases is extremely important. The white caseous exudate in the conjunctival sac of a bird affected with vitamin A deficiency may resemble the eye infection in laryngotracheitis, but the absence of respiratory symptoms and the presence of nodules in the esophagus positively identifies this deficiency. In localized fowl cholera or streptococcus infections changes may be seen in the eye, sinuses and nasal cavity that resemble those described for laryngotracheitis, and a bacteriological examination is necessary for differentiation. And yet, the absence of gasping, a more prolonged course and the presence of an odor is suggestive of one of the bacterial infections. In bacillary coryza there may be mild initial gasping and afterward a nasal discharge, but periorbital swelling, an odor and a more protracted course help to exclude laryngotracheitis. The coccobacilliform type of coryza resembles the bacillary type except for a far more extended course. Again, bacteriological examination is resorted to for positive identification of the coryzas. Fowl pox infection of the eye or larynx produces changes suggestive of laryngotracheitis. The eye type is far more chronic than in laryngotracheitis infection, and the caseous plug in the larynx is more adherent and of longer duration than in laryngotracheitis. In these cases inoculation of emulsified exudate on the scarified comb of a bird susceptible to pox causes the development of easily-diagnosed pox lesions within seven days. In very rare cases and usually in old birds, an infestation of air sac mites may be severe enough to provoke gasping. The mites are easily seen in the abdominal air sacs, or with the microscope in tracheal mucus. Similarly, in young chicks an infestation of gape worms causes gasping, but an autopsy discloses the nature of the disease. Pullorum disease in chicks over a week old is often associated with nodules in the lungs, which cause a labored breathing. Aspergillosis infection provokes similar symptoms. In the former, nodules may also be seen on the heart and in the gizzard; in the latter, heart and gizzard lesions are absent but air sacs may be affected. In both cases a bacteriological examination should be made.

Bronchitis is the most difficult disease to eliminate. However, it is usually found in baby chicks which show labored breathing. Autopsy shows mucus or caseous plugs in the bronchi, occasionally fibrinous pericarditis and clouding of the air sacs or a collection of yellowish exudate therein. In adults the rattling breathing, lasting two or three days, gives way to a nasal discharge of three or four days' duration. Usually there is no disagreeable odor about

the head. Autopsy never shows blood or a plug in the larynx. The mortality in chicks under three weeks may be over 50%,

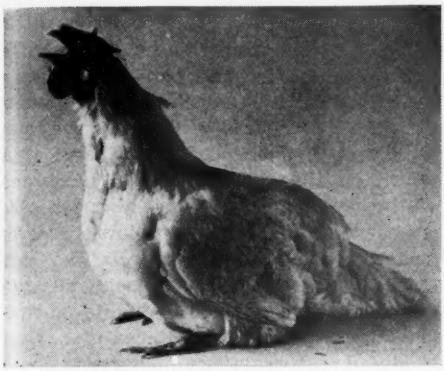

Fig. 1. Infectious laryngotracheitis; attitude during inspiration.—*From Calif. Agr. Ext. Circ. 8.*

but adults rarely die and only suffer a lowered production.

Post-mortem examination is not sufficient to identify laryngotracheitis or bronchitis in a bird showing only a nasal discharge so that it is necessary to apply an immunity test to known recovered birds. This is accomplished by simple vaccination with laryngotracheitis vaccine. A reading is made on the fifth day and if the bird shows a "take," the disease from which it recovered could not have been laryngotracheitis. This test should not be applied on the poultry farm because it could introduce the virus to a farm which might be free of it.

■ There is no specific drug treatment for laryngotracheitis and yet many birds can be saved if caseous plugs in the larynx are carefully removed with tweezers. Eyes, nasal cavity and sinuses may be freed of exudate and suitable antiseptics applied. The outcome of the cases having blood or mucus in the trachea will depend entirely on the bird's ability to free itself of the exudate. To this end, affected birds isolated in more comfortable quarters in small numbers will be able to care for themselves better than under flock conditions. Isolation for the purpose of preventing spread of infection is useless.

■ A method of immunization has been developed which is widely used. The results are as nearly perfect as those for any disease in any animal. In other words, immunization is not associated with any mortality, loss in weight or egg production and an immunity is established within nine days that lasts for life. Immunization should be more widely used because thou-

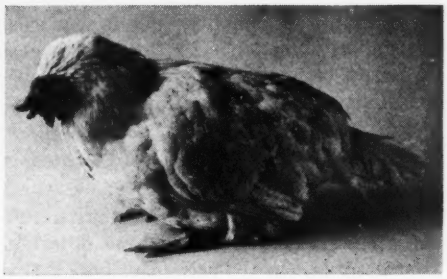

Fig. 2. Infectious laryngotracheitis; attitude during expiration.—*From Calif. Agr. Ext. Circ. 8.*

sands of outbreaks are still diagnosed by the standards of years ago, that is, they are diagnosed as "roup" or "colds." On the other hand, vaccination should be restricted entirely to the following conditions:

1. Emergency vaccination.
2. Immunization before an outbreak on a farm where infection is enzoötic.
3. Immunization of a flock into which known survivors (usually breeding males) are to be introduced.
4. Immunization of recently established flocks in a known infected poultry colony.

In the first instance we are dealing with a flock that has acquired the disease for the first time. The object is to prevent further spread of the disease within the flock, and success depends on immediate vaccination because immunity is not solid until nine days have elapsed. Vaccination of non-affected pens should be done first, so that infection is not carried to clean pens after the handling of infected birds has contaminated the hands and clothing. Similarly, in infected pens affected birds should not be handled or vaccinated.

In the second case, we are dealing with a farm in which the disease appears each

year because of the presence of "carriers." The object here is to vaccinate before the expected outbreak that usually occurs in the fall. Consequently, prophylactic vaccination of young stock is done in the summer when all are of suitable age, that is, over six weeks. If pox vaccination is also practiced, both vaccines may be applied at the same handling. Combined vaccination should be done when the birds are not more than three months old in the case of Leghorns, or four months in the case of heavy breeds, since there is an upper age limit in pox vaccination.

Since traffic in live adults is a poor practice, vaccination in the third category should be infrequent.

Vaccination justified by the fourth condition has essentially the same object as that described in the second instance; that is, prophylaxis, and so may be done after the flock is six weeks of age.

■ In order to understand the theory behind the method of vaccination let it be recalled that in the natural disease the virus attacks the epithelial tissue of the respiratory tract and does not reach the blood stream. Death occurs only because of suffocation. Therefore, in vaccinating one applies the fully virulent virus to the cloacal mucosa. Here it is in contact with the type of tissue (epithelial) that it has the capacity to attack, but the disease process set up is harmless because suffocation cannot occur. Moreover, the virus does not enter the blood stream to reach the tracheal mucosa any more than in the natural disease the virus reverses the process to reach the cloacal mucosa. Consequently, the local cloacal inflammation is harmless, and subsides as soon as sufficient immunity is developed, that is, in six to seven days. The immunity is general and lasts through life. The only difference between the local, artificially-induced disease in the cloaca and the natural disease in the respiratory tract is that virus is never found in the cloaca after the local reaction disappears — a vaccinated bird never becomes a "carrier."

A package of commercial vaccine contains a vial or hermetically sealed, evacuated ampoule of dry active virus. In the latter case a small file is supplied to mark the glass for opening. There is also a bottle of 50% glycerin with which the virus is to be mixed, and a small application brush. Two kinds of virus (vaccine) are available, viz., that from fowls in which the disease was produced artificially and that grown on the chorio-allantoic membrane of the developing egg. In the latter case the virus can be grown absolutely free of bacteria, which is impossible in the case of that from the fowl. Although all vaccines are tested for contaminants, anyone can appreciate the advantages of a virus produced in the absence of bacteria.

An important point is that the vaccine be of high and lasting potency. Mere cultivation on the developing egg does not insure lasting potency as this is entirely a matter of the method of preservation. Unfortunately some vaccines that were entirely inadequate have been put on the market. Such vaccines produced a low percentage of "takes," with the result that the successfully vaccinated birds eliminated virus from the vent which contaminated the respiratory tract of those not successfully vaccinated, and in nine to ten days these latter began to show symptoms and die of laryngotracheitis. It might be thought that weak vaccine could be eliminated by a potency test before marketing. Actually all vaccine is tested for potency before release, but such a test only indicates the potency at the time and gives no clue of its keeping quality.

■ The technic of vaccination is simple. The virus is mixed with the diluent away from the chicken house and the hands cleaned. The mixed vaccine should be supported by a block of wood into which a hole of suitable size has been bored. Young stock on range should be cooped the night before in order to be easily caught. The vaccination should be done early in the morning while it is still cool. A catching crate with a sliding door that can be placed against a small opening in the colony house

will facilitate the handling of birds. Such a crate has a hinged opening in the top to permit removal of the chickens. Emergency vaccination will usually have to be done when the layers or breeders are housed, that is, in the winter, so that the work has to be done inside. Consequently, the method of catching the birds will depend upon facilities and to some extent on the breed or even the time of day. Light breeds might have to be confined behind wire under the dropping boards and run out at one end into a catching crate. Care to prevent crowding and smothering should be used. Two light wire frames hinged together may be held to make an angle behind which birds can be gathered in a corner of the house, but this serves only for heavy breeds. In some cases emergency vaccination is done at night. In a long type house the end room is vacated and lighted and the birds are taken from the roosts of the adjoining darkened room and brought in for vaccination and left there. Then the emptied room is lighted for working and birds are brought in from the adjoining room.

In any event, the operator is seated with the block holding the vaccine at his right. The bird is held between the operator's legs with its head down and its back to the operator's left. By means of the thumb and index finger of the left hand the upper lip of the vent is evaginated to expose the mucosa, onto which the virus mixture is painted in a manner to avoid excessive contamination of the feathers and surrounding parts. For each vaccination the brush is recharged and the excess rubbed off lightly at the neck of the vaccine bottle. If the vent is soiled it should be cleansed with gauze, but this is rarely necessary. A brush soiled during vaccination should be cleansed before redipping in the vaccine.

Experience in vaccinating can be gained in a short time, and the number that an experienced operator can do in an hour will depend largely on the speed that chickens can be handed to him. A rate of 500 per hour is not unusual.

■ Five days after vaccination several birds should be examined for "takes," which show up as an inflammation, exudation and some swelling of the cloacal mucosa. A sufficiently potent vaccine should give over 95% readable "takes" in known susceptible birds. If one has had the misfortune to select a vaccine that is not sufficiently potent, as indicated by a low percentage of "takes," a "break" may be expected in the next five days unless those that failed to show a "take" are immediately revaccinated. But if one has 95% readable "takes" there is no need to worry about the remaining 5% as experience has demonstrated that these are immune also. Very likely the cloacal mucosa of these birds was mildly infected too, but the inflammation was not pronounced enough to justify a positive reading.

In emergency vaccination a higher percentage of "no takes" is to be expected. The reason for this is that some birds will have had a mild respiratory infection which protects them from cloacal infection. Immunity is solid whether the respiratory or cloacal infection be mild or severe.

As already indicated, the systemic reaction to vaccination is so mild that there is almost never a disturbance to egg production or growth. In very rare cases a slight decrease in feed consumption and activity may be noticed from the third to the fifth day. In view of this no special after care is recommended.

As long as vaccination is justified it does not create a greater hazard to other flocks in the vicinity. If the disease is enzoötic on a farm the flock will have its annual outbreak anyway, and consequently be a hazard at that time. Moreover, each outbreak produces "carriers" which perpetuate the disease. But, if the young stock is successfully vaccinated each year no "carriers" are produced and after survivors of the last outbreak have passed their period of usefulness and are disposed of the farm is cleaned up. Theoretically, vaccination may be discontinued at this point; however, the majority of poultrymen prefer to continue vaccination and be assured of protection.

Lymphomatosis and Leucosis

By E. L. STUBBS, Philadelphia, Pennsylvania
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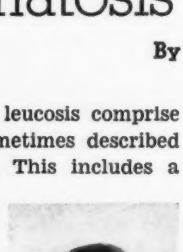
LYMPHOMATOSIS and leucosis comprise diseases that are sometimes described as the leucosis complex. This includes a variety of diseases, some that show cellular infiltrations, diffuse or localized, and others that show blood dyscrasias of various kinds. Some investigators have presented evidence to show that certain of these conditions can be separated and given a more definite terminology. Others include all in one group and assert that a single cause is responsible for all. The result has been confusion and at present proper clarification seems impossible, particularly for those who have been unable to follow the investigation in this field.



E. L. Stubbs

Lymphomatosis is a term commonly used to indicate a hyperplasia or proliferation of lymphoid tissues. It generally means accumulations of cells that are believed to come from lymphoid tissues. Lymphomatosis occurs in some instances in localized areas with tumor-like formations, while in other instances it occurs in diffuse form with widespread infiltrations. Lymphomatosis may be found affecting certain organs, such as the liver and spleen, or it may be widespread, involving many of the lymphoid tissues as well as other tissues.

Lymphomatosis, etymologically, means full of neoplasms of lymphoid nature, but it has come to be used to include a rather wide variety of conditions in poultry diseases, the neoplastic character of which has not been definitely shown and even those affecting cells other than lymphoid cells. These diseases are neurolymphomatosis, or fowl paralysis, hepatolymphomatosis, the so-called "big liver disease," visceral lymphomatosis, various tumor-like areas, iritis, the so-called "gray eyes" and some writers include the various forms of leucosis.

The term lymphomatoid diseases is sometimes used to include disorders of the lymphatic and hematopoietic systems, the nature of which is not well enough understood to permit of simple classification. Some are accepted as neoplastic, others as infectious, while the origin of others is still obscure.

■ Lymphomatosis is found everywhere and is causing more and more alarm, since the losses it occasions are considerable. Many studies of this disease are being made, with results that are irregular, confusing, and productive of few facts on which to base advice regarding its prevention, control and eradication.

The etiology of lymphomatosis is obscure and not well understood. Many attempts have been made, under a wide variety of conditions, to isolate the causative agent. This work has presented insufficient evidence for proof. Many believe that a virus is the cause, some believe that it is neoplastic in nature, and others that heredity accounts for its appearance.

Neurolymphomatosis (fowl paralysis) is one of the most prevalent forms. The disease was called neurolymphomatosis because of the frequency of derangement of the nerves. When first described in young birds on range, it was called range paralysis. The alteration first described was a cellular infiltration of the nerves, which accounted for the nerve derangement and the symptoms of fowl paralysis. It is generally stated that these cellular infiltrations of the nerves belong to the lymphoid series. It has also been found that they not only accumulate in the peripheral nerves but in the central nervous system and also in many other tissues. This is particularly true of the ovary, liver and the iris; and

the term lymphomatosis is therefore coming more and more into general use for this disorder.

The original work of Pappenheimer in neurolymphomatosis indicated that it is infectious in nature, yet most experiments recorded leave doubts in this regard. Particularly when fowl paralysis is accompanied by localized cellular infiltrations in the nature of tumors, there is an apparent analogy to neoplasms.

Some outbreaks remain confined to chicks hatched from certain groups or to birds purchased from a single source, even when mixed with others in the same environment. Frequently, where two breeds are kept, only one becomes affected, the other remaining entirely free, even though in the same environment and in close association. This gives credence to the opinion that heredity, at least in some outbreaks, plays an important part in the production of this disease. Some believe that the disease is transmitted through the egg from parent to offspring. Others believe that a tendency is inherited so that when other unknown conditions may be present, the disease develops. In many instances it seems that the progeny from affected groups shows a high incidence of the disease, while in other groups a lower incidence is found in the offspring than in the parents.

It appears that in most flocks in which the disease becomes serious there has been an opportunity for it to have been introduced by purchase of eggs or infected stock. There is also considerable evidence to show that once the disease is introduced it spreads rapidly, although there is little experimental evidence to show that it spreads by contact. It is well agreed that coccidiosis and intestinal parasitism do not in themselves cause paralysis, and it is probable that the only part they play is to lower vitality and resistance.

Our own work during the past two years, conducted with a flock turned over with the grant of a farm, shows a tendency for paralysis to develop in certain families. Some individuals in those families seem to have a tendency to transmit the disease.

One of the serious difficulties is that chickens may suffer from lymphomatosis without showing any clinical evidence of the disease or any discernible lesions. This, together with the difficulty experienced by most careful workers in transferring this disease artificially, holds up the progress that ordinarily should have been made. It seems probable that certain factors of which we are not yet aware play a part in producing the conditions necessary for the development of lymphomatosis. Until those factors can be determined, the basis for making sound recommendations for its prevention, control and eradication will be difficult.

■ Leucosis is a term used for the leucemias and the leucemia-like diseases of fowls, diseases that are difficult of diagnosis without considerable study, and sometimes impossible of differentiation. Some forms of leucosis are transmissible, facilitating their study, whereas others have not been shown with certainty to be transmissible and are not well understood. Some forms manifest definite blood alterations which aid in diagnosis, while other strains do not, thereby adding to the difficulties of differentiation and contributing to confusion in regard to their etiology.

The fact that definite blood alterations are produced by some strains, particularly those which can be easily reproduced and which result in the same changes at all times, gives rise to the opinion that these strains are pure and result from a single etiological agent. Other strains are believed to be quite complex, capable of producing a variety of conditions. This leads some to believe that a single etiological agent is capable of producing a wide variety of manifestations; it seems much more logical, however, to think that such complex strains are mixed strains rather than a single strain, and that the reason a wide variety of manifestations are obtained, is that such strains contain several different disease agents.

There is common agreement that the various types of leucosis are fatal. The course is usually rapid. Many birds remain

in good flesh and continue to eat until death, while others lose flesh rapidly and are emaciated at death.

Erythroleucosis is characterized by anemia, producing a paleness of the skin, particularly of the comb and wattles. There are many immature red cells in the peripheral blood, together with large numbers of precursors of erythrocytes. As the blood becomes more severely involved, icterus appears with a distinct yellow coloration of the comb and wattles. The skin bleeds easily at the least disturbance, particularly over the neck, breast and wings. Death may occur before symptoms are noticed or soon after they appear, frequently while the birds are still in good condition. Rigor mortis sets in almost immediately, the birds often becoming rigid within a few minutes. Post-mortem examination shows hemorrhages scattered through the muscles of the breast and over the thighs, with all the tissues pale from the anemia. Often there is hemorrhage from the liver or spleen with a pale blood clot free in the abdominal cavity. The liver, spleen and bone marrow are swollen and may show a distinct reddish color.

Myeloid leucosis may present many of the same changes as found in erythroleucosis. The predominant cells are large, irregular myeloblasts that flood the circulation, producing a paleness and, with severe blood involvement, an icterus similar to that of erythroleucosis. Post-mortem examination shows hemorrhages scattered through the pale tissues, which become rigid soon after death. The spleen is often enormously enlarged and, together with the swollen liver, shows a paleness from the crowding of these organs with the myeloblasts.

Lymphoid leucosis is rarely diagnosed prior to death and is believed to exist longer than the two preceding forms of leucosis. It is difficult to palpate the very large liver frequently found in these cases. Attempts have been made to use the fluoroscope and Roëntgen rays as an aid to diagnosis, but without success. The spleen is often enormously enlarged in these cases. The liver is often greatly enlarged, frequently without a corresponding swelling of the spleen, and this has given rise to the term hepatolymphomatosis for this type of leucosis. Two forms of swelling of the liver are recognized, one the diffuse or generalized form in which the entire liver is involved, and the other a localized and more or less tumor-like form, quite irregular in its distribution.

The swellings in the organs in each form of leucosis are caused by accumulations of cells. Erythroleucosis shows large numbers of immature erythroblasts and their precursors flooding the circulation in the blood vessels of the organs and crowding the sinusoids of the liver. Myeloid leucosis shows large numbers of the precursors of granular leucocytes in the circulation, and around the blood vessels of the liver and spleen. Lymphoid leucosis usually causes no alteration in the peripheral blood, but is characterized by accumulations of large cells assumed to be lymphoid in nature. These cells resemble large lymphocytes, but evidence is lacking to show that they are lymphocytes, and there is no evidence so far as we are aware to show that maturation occurs.

■ The lack of information about the fundamental nature of lymphomatosis and leucosis and the way they spread means that we must rely on general measures rather than specific methods for their prevention, control and eradication. New stock should be obtained from sources that are free from these diseases. Rigid culling should be exercised to maintain flocks that are vigorous and high in resistance. Careful methods of feeding, management, hygiene and sanitation should be used to prevent the development of suitable sites for disease to gain a foothold.

No drugs have been found to be of any value in these diseases; no mineral or vitamin deficiency has been shown; and no method of prevention or cure is known. The successful handling of this group of diseases will depend on methods evolved from further investigation and research.

Fowl Pox

By J. W. LUMB, Manhattan, Kansas
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FOWL pox has a variety of synonyms such as avian diphtheria, contagious epithelioma, chicken pox, sore-head, and canker. Fowl pox is very infectious for chickens and turkeys; other species of fowl and birds are also susceptible. The disease may be manifested in two different types: the skin type, in which eruptive pox pustules appear upon the comb, face, eyelids, and wattles; and the throat type, which appears in diphtheritic membranous patches in the throat and mouth. Both types, as well as secondary infection, may appear in the same bird. Fowl pox is quite common in eastern Kansas and occurs most frequently during the fall and winter months, often causing great losses in production.

Cause

Fowl pox is caused by a filterable virus. Either one or both of the two types of the disease are caused by this virus. It is resistant to drying and is contained in the scabs which fall from infected birds, so that premises once infected may carry the infection for several months. The virus may gain entrance through abrasions of the skin made by the birds in fighting or pecking one another while feeding, or through injuries sustained in other ways. Mosquitoes may carry the infection and inoculate birds by biting them. The virus may be picked up in the form of scabs in the feed or water and may inoculate the birds through the mucous membranes of the mouth or digestive tract. The virus may be carried from farm to farm in infected birds, in birds which have apparently recovered but may still expel the virus, in crates, sacks, or other equipment which has been around sick fowls and into or upon which the virus may have dropped.

Symptoms

The skin type is characterized by the appearance of small, round, raised, blood-blister-like, grayish-coated spots. These soon dry down into yellowish brown scabs which may or may not enlarge and join together to form larger scabs. Removal of the scabs reveals a rough, raw surface

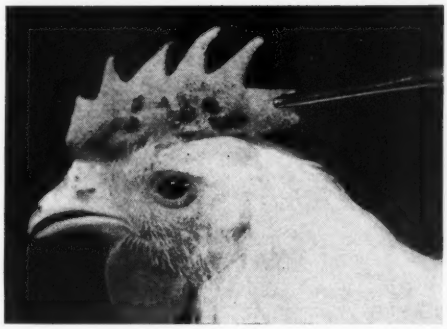

Fig. 1. Fowl pox lesions on the comb.—*Photo courtesy of Robert Graham.*

which bleeds easily. Occasionally, only a few pox develop; in other cases, the face, comb, wattles, ear lobes, and eyelids, as well as the corners of the mouth, may be covered with pox lesions. In extreme cases, pox eruptions may appear on other unfeathered surfaces. The pox scabs may remain for a period of from one to three weeks before becoming detached, after which healing of the lesions takes place. If only a few pox are exhibited, the birds may recover quickly. If large portions of the head are covered, the disease usually is accompanied by a systemic reaction such as sleepiness, loss of appetite and weight, and drop in egg production, with possible death. The type of pox which affects the mouth and mucous membranes of the throat and head causes the formation of raised, yellowish canker sores. This canker tissue is firmly attached, and the infection is progressive, gradually extending itself until large portions of the tongue, mouth, throat, or windpipe may be involved. These conditions may cause disfiguration of the mouth, head, or eyes, or may cause difficult breathing. Such birds lose weight, become anemic, and may die or remain

unthrifty for a long period of time. If, however, recovery does take place, it often is complete, and the bird may become a profitable producer even though one eye is lost.

Identity and Lesions

Fowl pox is identified largely through the formation and occurrence of pox spots and false membranes upon the face, comb, wattles, eyes, nose and throat of affected birds. Aside from these typical lesions, no other visible changes are caused by fowl pox virus.

Prevention

1. Chickens or turkeys which have had fowl pox or have been vaccinated against that disease will carry and may spread the disease for two months after becoming apparently normal. So, in adding such birds to unvaccinated or non-immune flocks, this factor should be borne in mind. Returned show stock may also carry the infection.

2. Shipping crates and used feed sacks may carry the virus scabs with them, and for this reason should be thoroughly disinfected before contacting normal flocks.

3. The surroundings should be kept in a sanitary condition at all times. There should be no breeding places for mosquitoes, as these insects may carry the virus for at least two weeks.

Control

1. If only one or two birds become infected and are noticed immediately, kill and burn them at once. Clean out and burn the litter, clean and disinfect the house and equipment, giving special attention to the watering vessels. The flock should be fet a good ration and have access to abundant succulent green feed. These measures may terminate the outbreak if it has occurred in a previously uninfected neighborhood.

2. Fowls which recover from fowl pox infection usually are immune for the remainder of their lives. This fact stimulated the discovery of a method of immunizing birds by vaccination. Considerable experimental work was required, and various types of vaccine and methods of administration were tried before a reasonably satisfactory procedure was developed. Fowl pox virus has a special affinity for the skin so that vaccination methods are used which inoculate only limited areas of the skin surface of each bird. At present, two types of vaccine are in general use in this country: fowl pox vaccine and pigeon pox vaccine.

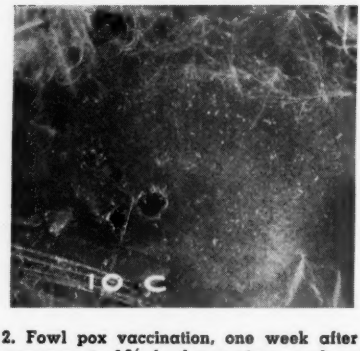

Fig. 2. Fowl pox vaccination, one week after two-stick exposure to 1% fowl pox virus; scab not dry nor receding.—*Photo courtesy of Robert Graham.*

Fowl pox vaccine is the active virus recovered from chickens infected with the disease or grown upon the chorio-allantoic membrane of the chick embryo. This is fully virulent, and if not handled properly may produce the disease in the natural form. Flocks properly vaccinated with unattenuated fowl pox vaccine are quite permanently immunized. This is used on young, healthy, and unexposed flocks.

Pigeon pox vaccine is made by using a pigeon pox virus. This vaccine produces only a mild reaction in fowls, and as a consequence, is often used in flocks which have been exposed or where infection already exists. In flocks where only a small percentage of the birds is infected and egg production is still good, pigeon pox vaccine is often used if vaccination is undertaken. However, the immunity is not as permanent as when fowl pox vaccine is used.

3. If it is decided to treat any sick birds, isolate them completely from the flock. Remove any diseased membranes that have formed, and paint the wound with tincture of iodine. Affected eyes should be cleansed and the affected membranes irrigated by sponging or immersion.

Vaccination with living fowl pox virus is

to be recommended only in flocks on premises where the disease has appeared previously. The use of the virus requires that vaccination of all young stock on the place be carried out the following season. Great care must be exercised to prevent dissemination of the infection to other premises by individuals who have handled the virus or diseased birds.

Good results must not be expected if flocks are heavily infested with worms or other parasites, or if they are low in vitality due to other causes. Best results are obtained by vaccinating healthy, immature birds, preferably those 30 to 90 days of age.

No general change in management or care of the flock is necessary, but it is essential that the flock be carefully protected against any unfavorable conditions for three weeks after vaccination and fed succulent feeds.

Eight to ten days after vaccination, 10 to 15% of the birds in the flock should be caught and examined to determine if swellings or scabs have formed at the point of vaccination. If 80% of these birds do not show swellings and scab formation, it indicates that the vaccination was improperly done or that the virus used had lost its strength through improper handling. Under ordinary conditions, where the percentage of "takes" is low it is advisable to revaccinate. A general reaction following vaccination usually occurs during the third week and after the scabs have formed and disappeared. The older the birds the more severe the reaction, and consequently, fewer "sticks" are desired or required as the birds become older. Laying flocks usually show a marked continued drop in production, while worm-infested and weak birds may die following vaccination. In vigorous young birds kept under favorable conditions, little difficulty and few losses are usually experienced; however, under certain conditions in birds which are already infected the losses may be more severe than would normally be expected.

The vaccine should be used within four days after it is received, and when it is not in use, it should be stored in a cool place. Satisfactory results should not be expected unless the work is carefully done.

Pigeon pox virus, because of the much less severe reaction on egg production and health, is frequently used in laying flocks in which an outbreak of fowl pox has occurred, or in flocks which have been exposed to infection. However, the degree of protection is lower and less durable than that resulting from the use of fowl pox vaccine.

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Encephalomalacia

Birds suffering from this disease often are called "crazy chicks," because of their queer actions. They suddenly become very nervous and active, then sit on their hocks and move backward by pushing with their feet. Examination of the brain shows a liquefaction of the cerebellum. Common grains contain fair amounts of the factor needed to prevent encephalomalacia, and soybean oil is a rich source of the substance.—*Univ. of Wis. Agr. Exp. Sta. Bul.* 440.

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Rickets

Chicks suffering from this disorder grow slowly, often are unable to stand, and have too little lime and phosphorus in their bones. The remedy is to expose the chicks to direct sunshine or ultra-violet irradiation, or else to feed a supplement containing vitamin D, such as cod-liver oil or other fish oils. It is also necessary to feed the correct proportions of lime and phosphorus in the ration.—*Univ. of Wis. Agr. Exp. Sta. Bul.* 440.

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Chick Pellagra

This disease is characterized by scabby incrustations at the corners of the mouth and on the legs and feet. The trouble is caused by lack of a vitamin of the B complex which was formerly known as B_2 or G. Like vitamin B_1, it is fairly abundant in air-dried grains, but may be low in rations consisting largely of kiln-dried grains. Liver is a good source of the factor, as are other meat products and yeast.—*Univ. of Wis. Agr. Exp. Sta. Bul.* 440.

Infectious Avian Encephalomyelitis *

By H. VAN ROEKEL, K. L. BULLIS, and M. K. CLARKE, Amherst, Massachusetts

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INFECTIOUS avian encephalomyelitis is an infectious and communicable disease of young chickens. Jones[1] in 1932 first described the disease among chicks and designated it as "an encephalomyelitis in the chicken." In 1934, Jones[2] referred to the malady as "epidemic tremor" because it was observed that many affected chicks manifested a tremor or vibration of the head and neck. In view of the fact that the disease affects chiefly the central nervous system and that an ataxia is observed more frequently and earlier in the onset of the disease than the tremor, the term "infectious avian encephalomyelitis" was proposed for this malady by Van Roekel, Bullis, and Clarke.[4]

Etiology and Distribution

Investigations[2, 3, 4, 5] have demonstrated that the etiological agent is a filterable agent which manifests characteristics of a virus entity. Its presence has been demonstrated in the brain, spleen, and liver. However, among these three organs the brain proved to be the most reliable source in obtaining the infective agent.

The distribution of the infective agent is not known at present. It has made its appearance in many states, with the greatest incidence apparently in the northeastern states. Since this disease has been discovered recently and since its manifestation may be confused with other chick disturbances, it is possible that infectious avian encephalomyelitis may pass unrecognized as such in certain sections.

Symptomatology and Mortality

Spontaneous cases of the disease among chicks 24 to 48 hours of age have been reported. Usually natural outbreaks occur when the chicks are from one to two weeks of age. In the sequence of symptoms, a slightly dull expression of the eyes is first observed and upon exercising the affected chick, evidence of slight ataxia is seen. The incoördinated gait may become more pronounced with time, the chick showing an inclination to sit on its haunches and exhibiting a reluctance to move. As the ataxia progresses, the chick will also exhibit a weakened cry or even a complete inability to cry. The tremor may be observed early in the onset of the disease, but more frequently makes its appearance after the development of the ataxia. The tremor varies in frequency and magnitude; it may be brought into evidence by exciting or disturbing the bird. As the disease progresses, the ataxia becomes more aggravated and general weakness increases until finally the chick is unable to move about for feed and water. This state of inanition hastens death. However, in commercial flocks the affected chicks are usually trampled or crowded to death before the inanition stage is reached. Occasionally the course may be very rapid and short, with death occurring within a few days. Lesions are microscopic in character, although in some chicks an internal hydrocephalus is observed. Microscopic lesions have been observed in various organs, but are most pronounced in the brain.

Morbidity and mortality rates in a flock may exceed 50% of the flock. Losses soon occur after the disease becomes apparent and continue even after affected birds reach maturity. All affected chicks do not necessarily die. Some birds seemingly make complete recovery, while others retain the

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*Contribution No. 355 of the Massachusetts Agricultural Experiment Station.

[1] Jones, E. E., 1932. Encephalomyelitis in the Chicken. *Science*, 76, pp. 331-332.

[2] Jones, E. E., 1934. Epidemic Tremor, an Encephalomyelitis Affecting Young Chickens. *Jour. Exp. Med.* 59:6, pp. 781-798.

[3] Annual Report of Massachusetts Agricultural Experiment Station for 1937. Bul. 347, 1938, pp. 92-93.

[4] Van Roekel, H., K. L. Bullis and M. K. Clarke, 1938. Preliminary Report on Infectious Avian Encephalomyelitis. *J. A. V. M. A.* 93:6, pp. 372-375.

[5] Jungherr, Erwin, 1939. Pathology of Spontaneous and Experimental Cases of Epidemic Tremor. *Poultry Science*, 18:5, p. 406.

ataxia and tremor in varying degrees. Birds affected in this manner may attain heavy egg production and produce vigorous, normal progeny. The mortality among the affected mature stock is rather heavy when the birds are maintained in cohabitation. Chicks which have survived an acute attack of the disease should be salvaged for slaughter at the earliest profitable age, providing the meat is wholesome, rather than retained for egg production.

While the losses occur chiefly among young chicks, the disease does not necessarily affect every hatch throughout a season. The outbreaks may run in sequence with an abrupt stop, or they may occur in random hatches. The incidence and mortality may vary among the different hatches. Several of the breeds, both light and heavy, have been found susceptible.

Transmission and Control

Under commercial practices it has been observed that the disease is transmissible among chicks through direct contact. Transmission in the incubator is also strongly suspected. As to the source of the infection, it appears that the infective agent is transmitted through the egg from the hen to its progeny. Hatching eggs exported from districts where the disease is widely prevalent to districts in which the disease has not been observed among native stock will hatch chicks with infectious avian encephalomyelitis. Day-old chicks taken from fumigated incubators and exported immediately to a district where the disease does not appear to exist, have been observed to develop the disease. Consignments of chicks from the same hatch sold to different customers have in many, if not in all, consignments developed the disease.

Experimentally, the infective agent has been transmitted by intracerebral inoculation and intranasal instillation, using a brain-saline suspension. The incubation period varied considerably, but in some instances symptoms appeared as early as five to six days after the inoculation. This was obtained in the first passage of the virus as well as in serial passages. The morbidity and mortality rates were increased by serial passage of the infective agent in chicks. A strain difference in susceptibility was observed among experimental chicks.

Transmission occurred also among uninoculated and inoculated chicks when in cohabitation. The disease was also reproduced in maturing birds (approximately three months old) through intracerebral inoculation. Turkey poults and ducklings were found to be susceptible to the disease upon inoculation. White mice, rabbits, guinea pigs, mature pheasants, and sparrows were found to be refractory.

Chicks manifesting the symptom complex of the disease were hatched from eggs that were inoculated with the infective agent at the beginning of the incubation period. This likewise was true when 10- to 12-day-old chick embryos were inoculated. Some chicks exhibited symptoms immediately upon hatching. These observations further substantiate the possibility that the disease might be egg-borne. However, the establishment of the complete cycle of infection awaits further investigation.

Little encouragement can be offered for the control of the disease. When first observed in a chick flock it might be expedient to remove all infected chicks to isolation quarters where they may be nursed along to broiler age for meat purposes. Good husbandry practices should be observed. Young, susceptible, day-old chicks should not be permitted direct or indirect contact with infected stock. Incubator hygiene and fumigation should reduce the spread of infection from one hatch to the next. Retaining started chicks in batteries in the same room or even the same building which contains the incubator is a practice which leads to disease dissemination. If owners of breeding flocks are experiencing losses from the disease from year to year, it would be advisable to replace the flock with new stock.

Animal pathologists in diagnostic and research laboratories should be familiar with the characteristics of this disease and determine its incidence in the different states, which may aid in the combat of the disease.

Enterohepatitis in Turkeys

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ONE of the greatest hazards to the turkey industry of the central states is enterohepatitis (blackhead). It has been estimated that in Missouri a large percentage of all the turkeys that die are affected with this disease. It is not unusual on the ordinary farm, where turkeys are allowed to run with chickens, to lose the entire spring hatch of anywhere from 100 to 200 poults. A few birds are apparently naturally immune to the disease or acquire some immunity through a light attack. These few survivors are the ones which are usually found on the ordinary farms in Missouri.

A. J. Durant

Cause

The disease is caused by a protozoan parasite known as *Ameba meleagridis* (Smith) or *Histomonas meleagridis* (Tyzzer). This parasite under field conditions ordinarily has an unusual life history. It is harbored by the common poultry cecal worm *(Heterakis gallinæ)*, found in the cecal or blind pouches in a large percentage of both chickens and turkeys. The parasite is resistant and capable of living for long periods, presumably in the egg of the worm. Chickens are occasionally affected with the disease, and because they practically always harbor the cecal worm, they are usually carriers of this parasite. Though turkeys are also carriers in many cases, their young are more likely to die when running on ground where chickens have run than when they run on ground where turkeys have been kept.

Because of the fact that the females lay the eggs it is only the female cecal worm that is capable of transmitting blackhead to turkeys. The old saying that the female is more deadly than the male is well exemplified in this case.

Van Es and Olney[1] found that the infection of blackhead remained in vacant yards from the middle of November until the middle of June. It is very probable that under natural conditions on the farm the blackhead parasite lives over from one year to another, unless it be exposed to zero weather, which Tyzzer claimed to be fatal.

It should be pointed out, that though the cecal worm is an important carrier and probably is the most frequent means of perpetuation and transmission of blackhead, it is not a necessary step in the life history of *Histomonas meleagridis*.

DeVolt and Davis[2] have shown that the parasite may live in the soil outside of the body of the cecal worm and that it may be carried readily by flies. They have also shown that the parasite may be discharged in the droppings as soon as the first day after infection and that an infected bird may spread the disease for one to seven days before symptoms appear. These new findings should, of course, be taken into consideration in attempts to prevent and control blackhead disease.

It is the author's observation, however, that if the cecal worm is not involved, very little natural blackhead will occur and that fly transmission and the other suggested new means of transmission are relatively unimportant.

Symptoms

When poults run on infected grounds it is unusual to see cases of blackhead developing under three or four weeks of age. If poults die before this time one may suspect coccidiosis or some disease other than blackhead. The first intimation of the disease in a flock is the appearance of a bird which lags behind the others. It be-

[1] Van Es, L. and J. F. Olney, 1934. Diseases of Poultry, Their Nature and Control. Nebraska Agricultural Experiment Station Bull. 290.

[2] DeVolt, H. M. and C. R. Davis. Blackhead (Infectious Enterohepatitis) in Turkeys, With Notes on Other Intestinal Protozoa, Maryland Agricultural Experiment Station Bull. 392.

comes droopy and dies within two or three days. Usually new cases rapidly follow the first appearance of a sick bird and the entire flock of poults is soon decimated unless measures are taken for the control of the disease.

A diarrhea usually accompanies the disease, but in younger poults this may not be evident. Sometimes in poults five to six weeks of age the orange to golden yellow droppings which are so characteristic of the disease in older birds may be present. However, one should not depend on this symptom in very young birds. In older birds there is nearly always a typical diarrhea which in Missouri may be considered pathognomonic of blackhead.

In older birds (birds from four months of age to adults), the disease is more chronic in form and the turkeys may linger from a week to a month. Birds affected with the chronic form become thin and weak; their eyes are sunken and their wings droop. Figure 1 illustrates the appearance of the chronic form of this disease in adults.

Diagnosis

In making a diagnosis of blackhead the veterinarian should bear in mind the symptoms which have already been described. In addition there are certain observations and procedures which will greatly assist in picking out affected birds before they have shown the debilitating effect of the disease.

As has been mentioned, the color of the droppings is a good indication of blackhead, and in a suspected flock, groups of four or five birds at a time should be confined in small pens or areas and each individual bird observed until it passes some droppings. Birds in the flock which are affected with blackhead can then be picked out by this means. If it is not possible to observe the droppings the bird should be caught and the short feathers surrounding the vent carefully examined. Very often the tips of these feathers will be stained with the characteristic yellow droppings. If there is no staining of feathers a rectal examination may be made with the index fingers. Rubber gloves should be worn when making this examination.

Post-Mortem Changes

To confirm the diagnosis, observation of the post-mortem changes is useful. The diagnosis of the disease from a post-mortem examination is usually comparatively easy. About the only other disease that may be confused with chronic blackhead in adults is tuberculosis.

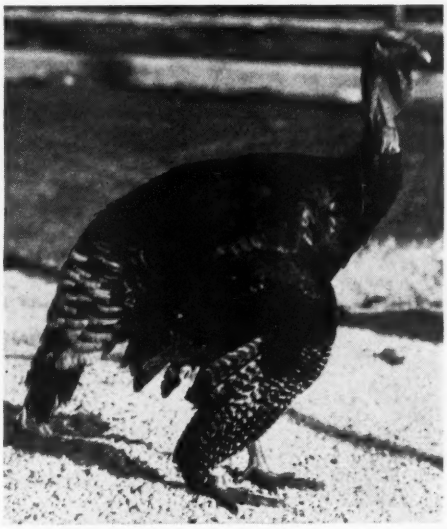

Fig. 1. Turkey affected with advanced case of blackhead. Notice the sunken appearance of the eyes and the drooping wings which are characteristic of this disease.

The turkeys that die from blackhead under natural conditions show marked changes in one or both ceca and the liver. The disease is characterized by the formation of large ulcers on the inner surface of one or both ceca and these ulcers are found under natural conditions more often toward the apex of the ceca. The ulcers vary in size from a pin head to large ulcers which occupy a majority of the inner surface of the organs. It is not unusual for them to perforate the ceca, resulting in a chronic peritonitis with adhesions of the ceca to adjacent intestines or tissues.

The disease develops first in the ceca, which furnish a suitable medium for the development of this protozoan. The parasite is then carried by the blood stream to the

liver, where it forms abscesses which result in extensive destruction, and combined with the lesions produced in the ceca, cause

Fig. 2. Liver of turkey that died of blackhead. Note that there are only two small areas of normal tissue in each lobe of this liver. Light areas indicate dense collections of embryonic cells due to action of virus.

the death of the bird. The abscesses of the liver vary in color from a mottled reddish to a dirty yellowish color. They vary in size from minute necrotic areas to large, round, sunken areas in concentric rings an inch or more in diameter. The sunken condition of these abscesses is an important point in differentiating blackhead from tuberculosis of the liver.

One other disease should be mentioned which might be confused with chronic blackhead in turkeys and that is one of the mycotic diseases known as thrush, due to the mold *Monilia albicans*. In this disease there are certain symptoms that might be confused with blackhead, particularly the dirty yellowish color of the droppings. It should be emphasized, however, that the yellow color is not as brilliant as in the case of typical blackhead, but there are certain stages in blackhead disease in which the droppings resemble those of thrush.

However, in thrush the affected birds usually live for longer periods and have a tendency to stand more erect with a continual swallowing movement of the throat, as if choking. Post-mortem examination of a bird affected with thrush shows no changes in the liver, the lesions being confined to the digestive tract, particularly the esophagus and crop, and in advanced cases a hemorrhagic inflammation of the intestines.

Prevention and Control

It is useless to attempt to raise turkeys on old, contaminated grounds where other turkeys or chickens have been running for the two years past. The poults should be raised on grounds where chickens or turkeys have not contaminated the soil with their droppings. It may happen that the selected grounds will prove to be contaminated, as indicated by the appearance of the disease in the flock. When a case of blackhead develops it indicates contamination and it is necessary immediately to remove the flock to other grounds.

Doctor Billings of the Minnesota Experiment Station has devised a plan of turkey raising which has been very successful. The plan is set forth in a bulletin entitled "Talking Turkey," which may be obtained by writing to that station. This is a detailed plan which is useful for professional turkey raisers rather than for the ordinary farmer who desires to raise just a few birds at a low cost.

If clean grounds are not available for the poults, they may be raised safely in a brooder house, even on contaminated grounds, provided that the brooder house is well bedded with clean wheat straw and kept clean and dry. The author has for three or four years past successfully raised turkeys in a 10x12 ft. brooder house on contaminated grounds with practically no loss from blackhead. If the turkey raiser desires to raise the turkeys to marketable age only, raised board or wire runs extending out from the brooder house can be constructed at very little cost and the birds successfully raised without their ever coming in contact with contaminated ground, provided that plenty of cod liver oil is fed to prevent malnutrition.

What to Recommend If Disease Appears

Any outbreak of blackhead may be controlled and checked within three or four weeks by a practitioner who gives the proper instruction to the turkey raiser.

If blackhead appears in a flock it is, as has been mentioned, an indication of contaminated grounds and it is necessary immediately to move the healthy birds in the flock. The birds should be carefully culled and all visibly sick poults removed from the flock and isolated for treatment. (See instructions under diagnosis.) The apparently healthy poults should then be put in a brooder house, the floor of which is covered with six or eight inches of clean wheat straw, and the birds fed a carefully balanced diet containing 3% to 4% of cod liver oil to prevent malnutrition; or the birds may be put on clean grounds. The turkey raiser should be instructed to examine the birds frequently and as often as a new case is found, the bird should be removed immediately from the flock and placed in quarantine for treatment. This procedure should be carried out as often as new cases show up. The disease can be checked in this manner in any flock within three or four weeks.

The healthy birds may then be kept on clean grounds where turkeys or chickens have not been kept for two years previously. Each of the healthy adult birds should receive a No. 000 gelatin capsule of turpentine when they are put on clean grounds.

Cecal Abligation as a Control Method

Cecal abligation as a method of control should be mentioned, although the author is not of the opinion that it is a practical and general method which can be adopted for the control of blackhead. The author[3] was the originator of the operation of cecal abligation for the control of blackhead. Schlotthauer, Mann and Essex[4] greatly improved the technique of this operation and their technique is recommended. In general, by ligating the ceca, blackhead is prevented in turkeys when running on infected grounds if well fed and cared for.

Treatment

There is no specific medicine for the cure of blackhead in turkeys. At the Missouri Experiment Station, however, good results have been obtained by the use of fluid extract of ipecac. This medicine may be administered in two ways. One is to give from 12 to 23 drops twice a day in one-half to one ounce of water by mouth for four to six days. It may be readily administered with a long-nozzle dose syringe, the nozzle of which is easily passed down the throat to avoid strangling. The other treatment consists in the administration of ipecac per vent by means of a two-ounce bulb syringe fitted with an eight-inch hard rubber nozzle. The nozzle of the syringe containing the medicine should be passed along the floor of the rectum for four to eight inches, depending on the size of the turkey. The bird should be held by the feet with its head down and the medicine gradually expelled so that it will fill up both ceca. Hold the turkey in the same position for about one minute after the medicine is administered. This treatment should be given twice a day for four or five days or until the bird shows signs of recovery. Twenty-three drops in two ounces of water to large turkeys and 15 drops in an ounce of water to small birds may be safely administered twice a day. The birds should be offered only soft foods such as mashes. Milk should be supplied instead of drinking water.

Birds that recover should be given a large dose of turpentine the day before they are put out with the rest of the flock. The reason for this is that some birds that recover are carriers of the parasite and will contaminate the grounds on which they run unless this dose of turpentine is given in order to eliminate the parasite from the ceca. The dose for an adult turkey is about a half dram, although larger amounts are tolerated. For small turkeys about 15 minims is sufficient.

Turkeys that recover from the disease are usually quite resistant to reinfection and are fairly safe from blackhead even when running on contaminated grounds.

[3] Durant, A. J., 1930. Blackhead in Turkeys, Surgical Control by Cecal Abligation, Bull. 133, Missouri Experiment Station.

[4] Schlotthauer, C. F., F. C. Mann and H. E. Essex, 1934. *J. A. V. M. A.* 85:455-457.

Botulism of the Domesticated Fowl

By J. L. WEST, Auburn, Alabama

BOTULISM (limberneck, food poisoning) causes heavy losses in fowl in all parts of the country. Losses have occurred in migratory fowl feeding upon decomposing vegetable and aquatic matter on the edges of lakes and in swamps. Infection from this type of material is also relatively common in domestic poultry flocks. Warm weather and moisture greatly facilitate the propagation of the bacilli, accentuating the possibility of infection and higher mortality. While botulism is encountered more frequently in warm weather, the infection is occasionally observed during the cooler months.

■ Botulism is an acute or subacute intoxication usually affecting a large number of fowl in the flock, frequently resulting in high mortality. Infection is characterized by weakness, paralysis, and coma terminating fatally within a few hours when lethal amounts of the toxin have been ingested, or merely weakness of the legs and wings, incoördination, drowsiness, and recovery within two or three days when sublethal amounts of the toxin have been consumed. The etiological agent is a potent exotoxin secreted by *Clostridium botulinum*. Types A and C only are infectious for fowl. These organisms are long, Gram-positive rods which are found widely distributed in the soil in all parts of the country. The nonsporulated organisms are not unusually resistant to chemical and physical agents; once sporulated, however, they resist boiling for several hours, as well as exposure to various disinfectants. The spores may be centrally located, but usually occur subterminally. It is believed that the majority of botulism outbreaks in the fowl are due to intoxication with the toxin of type C. The type of toxin causing the infection is impossible to determine by the symptoms; neutralization and animal inoculation tests are necessary to definitely establish the type. Infinitesimal quantities of the toxin are sufficient to produce severe toxic effects and only slightly more is lethal.

A vast variety of materials may serve as suitable media for the multiplication and toxin production of *Clostridium botulinum* bacilli. Wet, low areas rich in organic matter serve as an ideal habitat for the bacilli to multiply and produce toxin. Canned food products which have been improperly cooked, especially home canned corn, beans, spinach, etc., or faultily sealed containers, frequently are the sources of intoxications. Closely packed, damp hay, forage, bedding, damp corn, oats, wheat are favorable locations. Decomposing animal carcasses, such as dead fowl, rats, and mice, are also frequent sources of infection. Outbreaks of botulism frequently follow inundation of soil, the receding waters leaving dead fish, crayfish, and other forms of decomposing aquatic life, as well as closely packed and thoroughly soaked vegetable matter, which offers optimum conditions for the bacilli to grow and form the toxins. Ripe and decomposing fruits and vegetables, such as blackberries, mulberries, olives, potatoes, tomatoes, spinach, and vegetable leaves have been incriminated in several serious outbreaks. In general, foods or products of an alkaline or neutral reaction are more favorable for the growth of *Clostridium botulinum* organisms than those of an acid reaction. The larvæ of flies from decomposing animal carcasses or the recently mature flies from such pupal stages frequently contain highly toxic or lethal quantities of the toxin when eaten by fowl. The droppings of affected fowl may contain sufficient toxin to produce the disease in healthy fowl eating the contaminated feed.

The mortality depends upon the amount of the available toxin-containing material, the number of fowl having access to the material, the concentration of the toxin, and the amount of the toxin ingested by the individual fowl. A number of the fowl may ingest only a small amount of the toxin, recovery following in two or three days. The flock mortality may vary from

a few birds to, in some instances, the entire flock.

■ The symptoms correspond to the quantity and the toxic concentration of the ingested material. The first symptoms observed are dullness, partial closure of the eyes, incoördination and weakness. Mildly affected birds show weakness of the legs, droopiness of the wings, and disinclination to move. They walk with a staggering gait. Complete recovery is usually seen in two or three days, provided reinfection does not occur. The more severely affected birds are unable to stand, and the wings hang limply along the sides. The bird usually rests upon the keel bone with the head and neck fully extended and resting on the ground. The muscles of the neck are almost completely paralyzed, although the head and neck tend to assume the original position if the bird is moved. Paralysis of the throat muscles results in inability to swallow. Ptosis of the nictitating membrane is usually evident. The feathers are abnormally loose and large handfuls may be plucked with ease. The comb and wattles are usually a brilliant red color. The birds emit a rather pitiful squawk when handled. In the later stages they are comatose and lie as if dead. The feces are soft and pasty, and diarrhea may be present. Death may occur in a few hours or the bird may survive for a day or slightly longer. In turkeys, the head and neck are usually drawn over the back or twisted to the side, simulating torticollis. The feathers are seldom loosened as in chickens.

Botulism.—*Photo courtesy of Kans. Agr. Exp. Sta.*

The lesions of botulism are not characteristic. A catarrhal enteritis, with or without bright red hemorrhages scattered over the surface of the mucosa, may be seen. Petechiation of the heart and lungs may occasionally be observed. The crop frequently contains decomposed meat, feathers, maggots or larvæ, and decomposed vegetable matter, with a fetid or putrefactive odor, but the condition of the crop is indicative rather than pathognomonic. The presence of punctiform hemorrhages in the medulla, cerebellum, midbrain, are almost a constant finding in some species of fowl. Circumscribed areas of tissue necrosis may be found in the region of the small ganglion cells at times. Marked congestion of the meninges is usually evident.

■ As a rule, attempts to treat affected fowl are unproductive. The birds which are still capable of eating should be given a rapid purgative to remove any toxin present in the intestine. Epsom salt, two pounds per 100 pounds mature fowl, is satisfactory as a flock treatment. Castor oil or mineral oil, one tablespoonful per bird, administered individually, is of value in the prompt removal of the toxin as well as providing a protective covering over the intestinal mucosa, preventing further absorption of the toxin. Sour milk or buttermilk, liberally supplied to the healthy and mildly affected fowl, or given individually with a long-nozzled rubber dose syringe to the paralyzed fowl may be of value. The action of the lactic-acid-forming bacteria upon the botulinus bacilli and toxin tends to atten-

uate or perhaps destroy them. Polyvalent antitoxin adminstered to the healthy fowl in the initial stages of the outbreak is valuable provided the individual value of the fowl warrants the expense. The antitoxin is seldom of value in the treatment of fowl showing symptoms.

Birds affected with botulism in the early stages before complete paralysis had occurred. The bird on the right has the typical bowed neck in which only half of the neck is affected. The bird on the left has lost entire control of the head and is resting it on the floor. The one on the right made a nice recovery under treatment. The one on the left died from the disease.—*Photo by A. J. Durant.*

In the prevention and control of botulism the entire flock should be closely confined at the first indication of the outbreak and remain in confinement until the danger of further infection is past. The premises should be carefully searched for the source of the infection. All such material must be promptly destroyed to prevent continued infection. The unabsorbed toxin is not destroyed by the action of the digestive juices, hence sufficient infectious material may be present in the droppings of the affected fowl to bring about infection in the healthy birds. The droppings must therefore be collected and adequately disposed of. Carcasses of birds dead of botulism may also contain sufficient toxin to produce the disease if eaten by healthy fowl. Recent investigation tends to indicate continued toxin formation in the intestine by the bacilli following ingestion of the infectious material. The frequent occurrence of diarrhea increases the danger of infection of healthy fowl by contamination of the floor, feed, and water by the droppings. As a consequence, isolation of the fowl into three groups, severely affected, mildly affected, and non-affected is indicated if practical. The use of formalized toxin as a means of establishing immunity has at times been beneficial. The antigenicity of this product is rather unstable. The practical application of this procedure has as yet not been demonstrated for general use. The immediate injection of botulinus antitoxin (polyvalent) into all non-affected fowl confers adequate protection during the outbreak. Its practicability depends upon the economic value of the fowl. As lactic-acid-forming bacteria attenuate or possibly destroy the toxins of *Clostridium botulinus,* it would appear that supplying an adequate quantity of sour milk or buttermilk to the fowl at all times would be indicated, especially during the seasons in which botulism is most likely to occur. This measure should materially decrease the possibility of botulinus infections as well as minimize the mortality in the event of an outbreak.

Tapeworm Infestation in Poultry

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REPORTS concerning the prevalence of tapeworms in poultry show that these parasites are rare and of little consequence in some localities, while in others they are very prevalent, and present a real problem to the poultryman. Veterinarians who do any work at all with poultry should be familiar with the various phases of tapeworm infestation so that they can give proper directions concerning the prevention, control and treatment of these parasites.

Poultry Tapeworms

The following is a list of the tapeworms of poultry encountered in this country, with their intermediate hosts and kind of poultry affected. This listing is approximately in the order of their prevalence in Michigan.

Tapeworms	*Intermediate hosts*	*Hosts*
Raillietina cesticillus	Beetles, several species	(Chickens (Turkeys (Quail
Hymenolepis carioca	Beetles, several species. Possibly stable flies	(Chickens (Turkeys (Quail
Raillietina tetragona	House flies and two species of ants	(Turkeys (Chickens (Quail (Guinea fowl
Raillietina echinobothrida	Ants, land snails and possibly slugs	(Turkeys (Chickens (Pigeons
Choanotaenia infundibulum	Beetles and house flies	(Chickens (Turkeys (Ducks (Pigeons
Davainea proglottina	Slugs and snails	(Chickens (Turkeys
Amoebotaenia sphenoides	Earth worms	(Chickens (Turkeys
Hymenolepis cantaniana	Beetles	(Chickens (Turkeys (Pheasants
Raillietina magninumida	Beetles	(Guinea fowl

Mode of Spread (Life Cycles)

It is not necessary to tell veterinarians that tapeworms are made up of a head (scolex), a neck and a chain of segments (proglottids) but this statement will serve as a basis for a discussion of the life cycles and mode of spread of these parasites. The head serves as a means of attachment to the intestinal mucosa, and is the part from which the rest of the tapeworm grows. Actually the head fastens itself to the mucosa by means of suckers which may or may not be armed with hooks. Whether hooks are present or not, the tapeworm does not necessarily remain in one position for the duration of its existence in a given host. The number of segments possessed by tapeworms varies with the species and also with the age of the individual worm. There may be two or three or there may be several dozens of them. Each segment contains both male and female elements. Ultimately the last segments, usually not more than six, will be found to contain large numbers (several hundred) of eggs and when they are ripe each egg will have an actively motile oncosphere (*onkos-hook*). The oncosphere is the larva of the tapeworm. It is armed with six hooks. The length of time required by a tapeworm for the development of the first ripe segments varies with each species. In most cases it takes at least about two weeks. The ripe segments become detached and pass out with the droppings. When a suitable intermediate host ingests ripe segments or eggs the larval tapeworms will migrate to a suitable location in the host's body and there proceed to encyst. Approximately two weeks is required for the development of the cysticercus, a bladder-like cyst containing scolices. If the intermediate host, harboring fully developed cysticerci, is eaten by a susceptible bird the cysts will be dissolved and the scolices will pass to the proper location in the intestines where they attach themselves, segment formation commences, and a new tapeworm infestation is established. Thus the life cycle of some of the common tapeworms of chickens may, under favorable circumstances, take about one month for completion. Obviously it may take longer. Proper hosts are not always readily available. In fact, it is reasonable to suppose that the majority of oncospheres and cysticerci are never picked up by a suitable host, and consequently perish.

Symptoms

Young birds are much more severely affected by tapeworm infestation than are fully grown ones. Mature birds may tolerate a moderate infestation without outward symptoms. There are no pathognomonic symptoms. Retarded growth, paleness, or moderate cyanosis, emaciation, lameness, poor feathering, failure to come into or stay in production, failure to respond to good feeding, chronic, mild diarrhea, occasionally persistent straining and prolapse are all manifestations suggestive of worm infestation, although not necessarily of tapeworm infestation.

Gross Pathology

Catarrhal enteritis is the most conspicuous pathological effect of a tapeworm infestation sufficiently severe to be of any consequence. A flabby heart, thickening of the intestinal wall, and a certain degree of atrophy of the liver, spleen and muscles may be observed. The liver may also be somewhat darkened. In severe cases there may be desquamation of mucous membrane with a shrinking of the digestive tract. One tapeworm *(R. echinobothrida)* produces nodules in the intestinal wall. These nodules are, no doubt, sometimes mistaken for tubercles.

Micropathology

Mild infestations produce little or no structural changes. There may be areas of inflammation, sloughing of mucous membrane and formation of scar tissue.

Disease-Producing Mechanism

The mechanism by which tapeworms produce disease is not known. Mechanical injuries which interfere with digestive processes and pave the way for microbial infections are important. More or less mechanical occlusion may take place in severe infestations. Metabolic products given off by the parasites may be harmful and one might also assume that allergy to various by-products of the worms may enter the picture. Once severe inflammatory processes have been set up the products of disintegration of the host's own tissues contribute further to the pathogenesis of this disease.

Diagnosis

When symptoms suggest the presence of intestinal parasites a diagnosis in live birds may be established on the basis of finding proglottids in the droppings. One may also select a representative number of birds and administer a vermifuge. Such birds should be placed in batteries so that the droppings may be collected on trays or, better, in pans containing clean water. Segments or larger portions of tapeworms, expelled during the following 12 to 24 hours, can then be easily detected.

In selecting birds for post-mortem examination, it is a mistake to choose the very sick and emaciated ones. Experience has shown that when the pathological conditions in the intestines become advanced the tapeworms pass out, evidently because conditions in the host have become unsuitable for them. It is best to select, not only some sick birds, but also some that are in fairly good condition if one wishes to determine the extent to which tapeworm infestation exists in a flock. Birds killed for food may well be regularly examined for the same purpose. Since tapeworms may be very small and more or less covered with mucus and ingesta, one must examine the mucous surface very carefully. In difficult cases one should gently scrape the mucous surface with the back of a scalpel or with a pair of forceps, collecting the scrapings in a glass dish containing clean water. After letting this stand a few minutes one may decant the supernatant liquid and then carefully examine the sediment. Repeated washings of the sediment may be required.

The diagnostician should be able to determine the species of tapeworms encountered because suggestions for prevention and control must be based on the life cycle of the parasite, which involves the intermediate hosts.

Prevention, Control and Treatment

The formidable list of tapeworms and their various hosts, given above, makes one wonder whether absolute prevention of tapeworm infestation is possible if poultry are to be given access to the outdoors. To be able to eliminate the many species of

beetles, flies, ants, slugs, and snails involved, seems hopeless.

However, it must be remembered that the droppings of infested birds are the source from which the intermediate hosts are infected. Therefore, proper management of litter and droppings removed from the poultry house does much to reduce this source. Placing litter and droppings in screened pits, burning them, or removing them to locations far from ground occupied by poultry, greatly reduces the chances for infestation. Frequent rotation of runs and ranges helps also. Keeping the yards free from boards, boxes, rubbish of all sorts, and vegetative material with large leaves is very important because it removes hiding places for intermediate hosts, especially slugs.

In extreme cases one may have to resort to confinement of the flock in screened houses for two or more years. Since it is not always practical nor desirable to keep birds under such confinement, and since intermediate hosts are abundant, one must of necessity be prepared to find tapeworms sooner or later. In such cases the preventive measures mentioned above must be greatly intensified. Unfortunately we have no remedies that will remove entire tapeworms from the intestinal canal. However, iodine vermicide (Merck) removes the segments exposed in the lumen, and also kills a vast majority of the eggs contained in them. The result of this treatment is that the number of infective eggs is reduced to such a degree that chances for infestation become rare. Iodine also tends to restore appetite and vigor.

Promiscuous worming of birds is to be condemned. No treatment should be applied unless a heavy infestation demands that every effort be made to reduce the source and spread of the parasites. When such is the case, our recommendations regarding treatment are as follows:

1. Treat all the birds worth keeping with iodine vermicide (Merck) as soon as a diagnosis of worm infestation has been made. The dosage recommended is as follows: for birds large enough to be given individual treatment but not over two pounds in weight, one-half ounce. For birds from two to eight pounds in weight, one ounce. For heavier birds, 1½ to two ounces.

2. If the premises are thought to be heavily contaminated the treatment should be repeated in three to four weeks.

3. For the greatest possible protection to the next crop of chickens, three treatments should be applied, the first while the birds are on the range; the second at the time of placing the birds in the laying house; and the third at the end of the fly season, after the frost has disposed of most of the intermediate hosts.

4. If only a single preventive treatment is deemed advisable, it should be given after heavy frosts have taken place.

5. Since iodine suspensoid (Merck) kills worms and worm eggs, it is obviously the ideal disinfectant for contaminated poultry houses, and should be used where it is desired to kill parasites and their eggs as well as coccidia, bacteria and fungi. No other presently-known disinfectant, suitable for practical use, will kill all these disease-producing organisms.

Careful mechanical cleaning should precede the use of any disinfectant, otherwise its ability to destroy parasites will be nullified by dirt. If a choice has to be made between a thorough mechanical cleaning alone with soap solutions or lye solutions, or a disinfectant alone, one should always choose the former.

Kamala compounds of various sorts are widely used in attempts at removing tapeworms from poultry. The use of this remedy is entirely unjustified. Not only does it fail to remove tapeworms, but it has no ill effect on them. To make matters worse, kamala often affects birds very unfavorably, young chickens and turkeys being especially susceptible.

Gizzard Lesions

This trouble, which has been reported to be rather common in farm flocks in some areas, results in slow growth. Post-mortem examination shows crater-like lesions in the gizzards. Oats are a good preventive for gizzard lesions. Wheat and its by-products, bran and middlings, are fairly good, while corn is poor. This is one reason why, although it is all right to feed corn liberally, it is always wise to include some other grains or by-products in a poultry ration.—*Univ. of Wis. Agr. Exp. Sta. Bul.* 440.

Control of Common External Parasites of Chickens

By M. W. EMMEL, Gainesville, Florida
Florida Agricultural Experiment Station

THERE are many types and varieties of external parasites which are known to infest poultry. Lice, mites, ticks and fleas are encountered most frequently. Although light infestations often remain unobserved, the heavy infestations which usually follow result in decreased egg production, unthriftiness and lowered physical resistance. Blood-sucking external parasites may transmit disease.

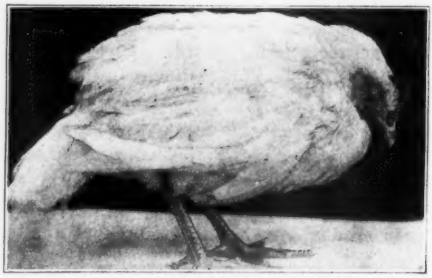
Lice

The body louse, shaft louse, head louse, wing louse and fluff louse are observed more frequently than other kinds of lice. Each species is named according to the location in which it commonly occurs and may be found readily by careful inspection while separating the feathers. Observations should be made immediately after separating the feathers, since certain species thus exposed scurry to covered areas. Heavy infestations cause considerable irritation and annoyance to infested birds.

Body Louse of Poultry, *Menopon Biseriatum.*

Poultry lice have chewing or biting mouth parts. They feed on feathers and débris on the surface of the skin. Lice spend their entire life cycle on the host and can live for only a short time off the living bird. The eggs (nits) are deposited on the down or feathers. After hatching, the parasite passes through a series of molts before reaching maturity. Three to four weeks usually are required for completion of the entire life cycle. Cool weather retards the life cycle.

Many methods of treatment consisting of dusting, dipping, greasing and fumigating have been recommended for the control of chicken lice. Of these various treatments the following are considered to be the most



A White Leghorn Cockerel Infested with Head Lice.

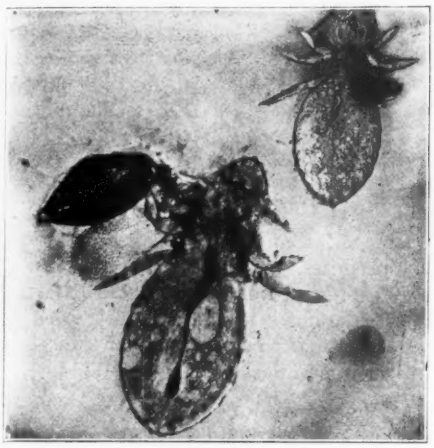
effective: (1) placing pinches of sodium fluoride among the feathers at a number of locations on the body; (2) dipping the birds in a solution containing ¾ to one ounce of sodium fluoride per gallon of water; (3) rubbing a small lump of 50% blue ointment on the skin immediately under the vent of each bird; (4) spreading a 40% solution of nicotine sulphate lightly on the perches before the birds go to roost; (5) adding 5% of commercial flour of sulphur to the regular ration for a period of three weeks.

Dipping should be done only on warm days and early enough in the day so that the birds will become dry before night. When nicotine sulphate is applied too heavily on the perches the birds often will be inclined not to roost on them the following night; this is particularly true during hot weather. It is possible that the effectiveness of sulphur may depend upon the bird's preening itself. In this manner sulphur adhering to the beak may be distributed over the body of the bird. However, the feeding

of sulphur is effective only when birds have access to a reasonable amount of sunshine. The effectiveness of any treatment used for the control of lice should be checked after several weeks and repeated if necessary.

Mites

The common chicken mite is a blood-sucking parasite which feeds on the chickens at night and hides in cracks and crevices during the day. In cases of heavy infestations mites can be found easily during the day. The presence of mites can be detected by careful examination of the cracks and crevices of the floors, roosts and nests.



Head and Neck Louse of Poultry, *Lipeurus infuscatus.*

The mites lay their eggs in cracks and crevices. After hatching, the parasite passes through several molts before reaching maturity. The entire life cycle requires about seven days for completion. The weather seldom becomes too hot or dry for mites to thrive. The adult can live approximately 100 days without food.

A simple method for the control of mites is to dust commercial flour of sulphur about the house and on the litter, dropping boards and nesting material. The movements of the birds will work the sulphur into the cracks. If the house has been cleaned sulphur may be sprinkled about the house and worked into the cracks and crevices with a broom. Either of these procedures is effective in three or four days and as a rule does not require repetition. Either treatment used several times a year serves as an excellent preventive measure.

The Depluming Louse, *Lipeurus Variabilis.*

Another effective treatment is to spray the cracks and cervices with a 10% solution of creosote or coal tar dip in kerosene. Caution should be used in applying this mixture to nest-boxes as the eggs may become tainted with undesirable flavors. Usually it is necessary to repeat this treatment at least once a week for two or three weeks before complete eradication can be obtained.

Other mites which occasionally infest chickens are: the scaly leg mite, the depluming mite, and chiggers or "red bugs." The scaly leg mite burrows under the scales of the legs, causing them to become thickened and covered with scabs. Softening the scabs in warm, soapy water and dipping the legs in a mixture of one part kerosene and two parts of raw linseed oil should be an effective treatment. The depluming mite and chiggers usually can be effectively controlled by dusting affected birds with sulphur.

Mites seldom infest dry, clean, well-venti-

lated and well-lighted houses. Thus sanitation is an important preventive measure.

Ticks

Chicken ticks, commonly called "blue bugs," are blood-sucking parasites. Heavy infestations often result in tick paralysis.

The eggs are laid in cracks about the house. Cracks on the walls and ceiling are favored locations. After hatching, the parasite passes through three periods of alternate feeding and molting before reaching maturity. The entire life cycle requires about 30 days. One female may deposit as many as 800 to 900 eggs. The chicken tick, like most other ticks, can live for long periods without food. Consequently, persistent efforts are necessary to finally rid infested premises of these parasites.

Spraying the cracks and crevices of the house with a 10% solution of creosote or coal tar disinfectant in kerosene every 10 to 14 days should be an effective treatment.

Fleas

The chicken flea or sticktight flea attaches itself to the comb, ear lobes and wattles. They usually are observed in clusters and appear as dark patches. They are difficult to remove mechanically as their heads are buried in the tissue.

The eggs are expelled from the female, usually with considerable force, while the parasite is attached to the host. The eggs hatch in from four to 15 days and the larvæ feed on excreta for a period of 15 to 30 days before they pupate. The pupal period varies from 10 to 19 days. Six or eight days are required for the adults to become active and attach themselves to the host. The entire life cycle requires from 35 to 50 days for completion.

Excellent control of sticktight fleas has been obtained in Florida by dusting sulphur on the surface of the soil in poultry runs and feeding 5% of commercial flour of sulphur in the mash for a period of three weeks. Sulphurization of the soil will control the young forms of the parasite as well as prevent further infestation. After six weeks sulphurized soil should be treated with three times as much agricultural lime as sulphur originally applied if one desires to cultivate the area.

M. W. Emmel

The feeding of sulphur will result in a reduction of infestation on the host.

Spraying houses with creosote oil and the application of sulphur ointment to patches of the parasites are helpful. Nest materials should be renewed. Birds should not be permitted beneath buildings where fleas might breed.

Fleas, mites, and ticks seldom infest sanitary premises. Thus sanitation is the keynote for the prevention of these external parasites. Houses should be constructed in such a manner as to be conducive to good sanitation practices.

* * * *

Slipped Tendon

This is a deformity of the legs. Trouble usually begins with enlargement of the hock joint, and later the tendons may slip off the tibia bone. The results are flattened hocks and bowed legs.

Slipped tendon is aggravated by too much inorganic phosphorus in the ration. One practical remedy is to feed less bonemeal, and another is to include ¼ pound of manganese sulphate in each ton of poultry mash.—*Univ. of Wis. Agr. Exp. Sta. Bul.*

* * * *

Of 2,131 specimens examined by the poultry laboratory of the Ontario Veterinary College during 1938, 1,999 revealed disease conditions. Pullorum disease accounted for 26% of the total; coccidiosis, 17%; nutritional disorders, 14%; intestinal parasites, 14%. There were over 50 cases each of coryza, enterohepatitis, and leucosis; less frequent were tumors, fowl cholera, enteritis, laryngotracheitis, tuberculosis, avian diphtheria, and miscellaneous infections and injuries.

An Evaluation of Poultry Biologics

By CLIFFORD D. CARPENTER,
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BIOLOGICAL products play an important rôle in the control of poultry diseases, both for the commercial poultryman with his flock of 2,000 layers, and the general farmer with his farm flock of 200. Even though Pasteur demonstrated apparent immunity against fowl cholera some 60 years ago, yet it was more than 30 years later that biologics of any kind proved to be of value in reducing avian mortality.

Pullorum Antigen

Twenty-five years ago it was found that the blood serum of a chicken carrier of *S. pullorum* would agglutinate cultures of this organism. This discovery paved the way for a control program of this serious economic disease which was quite promptly initiated in the New England area. The test as applied in this region consists of drawing blood samples, usually from the wing vein. These samples are allowed to clot, taken to the laboratory, and when the serum has collected, standard dilutions of serum and pullorum antigen are incubated for 24 hours and macroscopic determinations made for reactors.

This procedure requires that the birds be banded numerically and when the reactors have been determined they are removed promptly and either marketed for food or destroyed. Testing is followed by a cleanup of the premises and a careful disinfection of poultry houses, hatchery rooms and incubators.

That which began as a control program for pullorum disease in New England is rapidly becoming one of eradication since many flocks in that region have failed to show a reactor over a period of years. Where formerly a pullorum infection caused losses ranging from 10% to 90% of the brood, this carefully controlled program has saved millions of dollars for the industry and has permitted sound progress in breeding.

The test is highly accurate when placed in capable hands. True, all reactors may not be removed by one or two tests but the continuous application of a sound testing program accompanied by the prompt removal of reactors and a general cleaning up of the premises will eliminate the disease.

Clifford D. Carpenter

Plate Test Increasing

Several years ago Bunyea developed a method of determining carriers of pullorum in chickens known as the stained-antigen rapid, whole-blood test or plate method. This procedure involves the use of a stained antigen and can be applied in the field by mixing a single drop of antigen with a standard loop of blood from the suspected bird. Within two minutes the result can be interpreted. If a reaction is obtained, the reactor can be removed at once, necessitating thereby but one handling of the flock.

In capable hands the plate test approaches the efficiency of the tube test to a point where the average practitioner who is not equipped with laboratory facilities finds this method effective and more practical than the tube test. The plate test is less expensive to the industry, and is more easily and quickly applied; but, when a

series of plate tests show the flock to be without reactors and the owner is desirous of establishing a free flock, then the tube test should be used in accordance with the recommendations or regulations in that particular state, to be certain that no single reactor has been overlooked.

Pullorum testing, almost *per se*, has been the means of establishing a tremendous hatching industry in this country, totalling nearly a billion chicks annually. The National Poultry Improvement Plan, with its pullorum control phase, has furthered the reduction of baby chick mortality from coast to coast. Unfortunately, veterinarians are not always available in areas where pullorum testing is being conducted and further, many veterinarians either feel unqualified or fail to show a sufficient interest to accept this responsibility for flock owners.

Often overlooked by the veterinarian is the necessary control of pullorum disease in the hatchery, particularly in the case of hatching eggs from tested flocks and untested flocks, since the disease spreads rapidly in the incubator and among those recently hatched. Custom hatching should be done only in separate machines, preferably in separate rooms, and a careful fumigation program be instituted especially between hatches. Best results are obtained from the use of formalin and potassium permanganate in vessels, or suspended sections of cheesecloth soaked in formalin.

Fowl Pox Vaccine

Fowl pox vaccine is today a very stable, dependable product, suitable for easy and quick administration. It gives a solid immunity which, under normal conditions, remains effective during the business life of the chicken and turkey. The product should be properly refrigerated, the virus not mixed with the diluent until just before using, and no mixed material held for any period of time, since potency drops quickly, many times when standing only overnight. Nor should more than one bottle be mixed at a time.

There are two acceptable methods of applying the vaccine, namely, the feather follicle or brush method, and the stick or stab method. In either case, the secret of successful vaccination depends upon depositing some of the live virus into the cellular

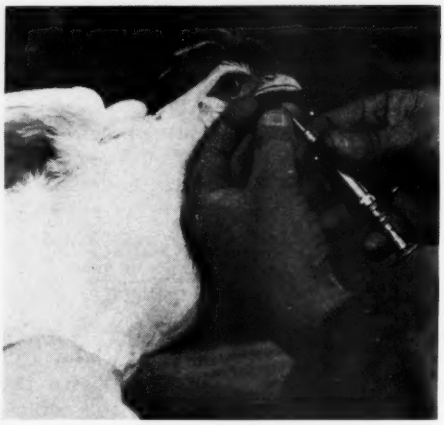

Fig. 1. Tuberculin Injection.—*Photo courtesy of Tuberculosis Eradication Division, B.A.I.*

structure of the skin—not on the skin. The follicle method gives the best insurance of successful results and is accomplished by removing not more than three feathers from chickens and two from turkeys from the region of the drumstick. The end of the vaccinating brush should be dipped into the vaccine, avoiding any unnecessary waste, and the bristles applied rather vigorously to the open follicles.

The stick method is applied by attaching two or three needle points to the end of a cork or wooden handle, allowing the ends to protrude about ⅛ inch, and wedging a small piece of cotton between the bases of the needles. This insures picking up enough of the virus at each administration to secure a good "take." The vaccine should be agitated frequently to avoid settling out of the suspended powdered virus.

The stick method may be applied to the drumstick or through the web of the wing, in which case the length of the needles is not so important. Some veterinarians employ two darning needles, using the heads of the needles with the eyes intact, thus insuring a droplet of vaccine entering the wound.

Chickens should be vaccinated between

the ages of eight and 12 weeks, thus interfering but little with normal growth. Care should be taken that birds to be vaccinated are free from colds, worm infestations and coccidiosis, else dire results may follow. Many successful poultrymen precede vaccination by a full day's feeding of a flushing mash containing a large percentage of dried cheese whey, the second day before vaccination, and repeat this same feeding on the tenth day following vaccination. Vaccinated birds should be examined for "takes" on the tenth day.

Fowl pox is equally transmissible to turkeys, and vaccination is just about as efficient and as practical. Turkey raisers should be advised, however, that vaccination should be carried out early in order to avoid any scab or scar tissue being evident at marketing time.

Pigeon Pox Vaccine

Fowl pox vaccine (pigeon strain) should be employed in vaccinating exposed chickens if fowl pox appears in a flock after laying begins. While the immunity conferred may not be as durable, yet egg production is not lowered from the effects of vaccinating as it would most certainly be if fowl pox vaccine of chicken strain were used; and in most cases if a fully potent pigeon strain vaccine be used, admirable protection is obtained.

Fig. 2. Tuberculin Reaction. Note the thickening of the left wattle.—*Photo courtesy of Tuberculosis Eradication Division, B.A.I.*

Tuberculin

Tuberculin is perhaps the least used of the veterinary biologics in poultry practice. As a diagnostic agent it is relatively accurate, but under many conditions it is highly impractical. Tuberculin has been used by the Bureau of Animal Industry during the past two or three years in the North Central States to determine the extent of avian tuberculosis, and, since avian tuberculosis is transmissible to swine, this diagnostic biologic has a definite place in veterinary medicine.

To the average poultryman, however, it has been known for a long time that merely testing and removing reactors will not clean up the disease. A rigid culling program must be instituted, together with a general cleanup of the premises, as in the case of the control of bovine tuberculosis, and the layers should be properly housed and segregated from other animals, especially swine.

Applied intradermally, tuberculin is quite accurate in detecting infected chickens. The material must be applied with extreme caution, using a small calibre dental needle, and injected into the edge of one wattle. The birds are examined 48 hours later for evidence of sufficient swelling to justify the diagnosis of tuberculosis.

Laryngotracheitis Vaccine

In recent years the commercial poultrymen of the Atlantic Coast region and the far West have found great security from a costly disease, laryngotracheitis. Originally thought to affect the bronchi, the disease was known for a while as infectious bronchitis, but it was later shown to attack the larynx and trachea instead.

Laryngotracheitis vaccine is perhaps the most perishable poultry biologic which the veterinarian employs. It must be kept under careful refrigeration, and once the powdered virus has been suspended in the dilu-

ent, it must be used promptly. It should never be exposed to direct sunlight, and on hot days the vaccine bottle should be kept in a pan of cracked ice or ice water.

Great care must be exercised in applying this product. The veterinarian should have a capable assistant, who holds the birds in a correct position to expose the vaccination site at the cloaca. The operator should be careful not to touch the birds unnecessarily; especially he should refrain from coming in contact with the head, since to deposit any of the virus around the head region might infect rather than protect the bird. Nor should the assistant come in contact with the vaccine or the brush.

In using laryngotracheitis vaccine, as is the case with all biologics, the directions of the manufacturer should be followed carefully. Failure to secure immunity usually follows when outdated or improperly refrigerated vaccine is used. A most important point is that improperly vaccinated birds may contract the disease, and following recovery, remain carriers for months. Properly vaccinated birds, however, do not become carriers, nor is the virus found in the cloaca or droppings after a few days.

Use in Midwest Limited

Laryngotracheitis is not a common disease in the Midwest, where the great bulk of the poultry population is confined to small flocks. Therefore this vaccine should be used on the average Midwest farm flock only after a positive diagnosis of the disease has been made either on the farm in question or in the near neighborhood.

Several diseases, such as chick bronchitis and coryza, or colds, may present clinical pictures similar to laryngotracheitis and needless intervention with this vaccine resulting from a wrong diagnosis is often the means of establishing the disease in the vicinity.

Biologics of Questionable Value

Often the veterinarian is confronted with a diagnosis of fowl cholera or fowl typhoid and is expected to make recommendations for control. Too often the practitioner relies on vaccination as the best procedure, but research in the last quarter of a century has shown that protection is not granted by the use of fowl cholera and fowl typhoid bacterins in this country.

Often these two similar diseases attack and destroy 1% to 5% of a flock of laying pullets, and then without any control measures having been established, leave as suddenly as they appeared. Such behavior is misinterpreted by both the veterinarian and the flock owner for immunity if it follows the use of these biologics. Both critical research and carefully checked field trials with control pens have shown no measurable protection to be afforded by the use of such products.

Again, fowl cholera may establish itself as a chronic infection of varying virulence in a flock and a steady but often unnoticeable loss results. It has been shown that keeping the layers indoors and employing reasonable sanitation will control these losses.

Attempts to prevent or eradicate coryza or infectious colds by the use of mixed bacterins seems likewise to be useless. Here again all scientific efforts to accomplish control by biological means have failed. Since the average mixed bacterin does not even contain the recognized causative agent of coryza, and further, since a natural course of the disease itself fails to establish durable protection, it can be seen at a glance that these products have no foundation for taking their place alongside of reputable biologics in a veterinary practice.

The poultryman's profits are but meager, and limited largely by mortality. More and more the general practitioner is counselling breeders, hatcherymen and flock owners to control these staggering losses in this billion-dollar industry. To employ biologics of value when needed is as important in the poultry industry as for cattle, sheep, and hogs; but to misuse or needlessly administer those biologics of little or no value, only continues to postpone the day when the general practitioner enjoys the same relationship with flock owners as he does today with producers of other farm animals.

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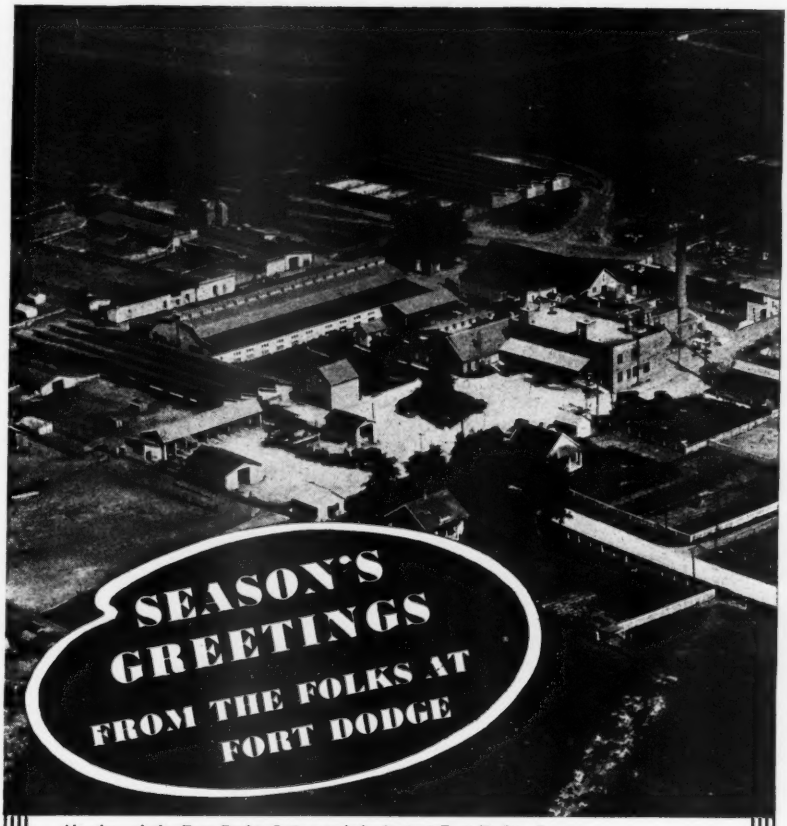

Air view of the Fort Dodge Laboratories' plant at Fort Dodge, Iowa

We are grateful for the new friends the year has given us — and for the old friends it has brought closer. In a true spirit of appreciation we extend to you our wish for a Christmas season full of joy and cheer, and a New Year of great prosperity.

D. E. Baughman D.V.S.

PRESIDENT,
FORT DODGE LABORATORIES, INC.

Army Veterinary Service

Transfers.—Capt. John H. Rust, III, from Fort Slocum, N. Y., to Hawaiian Department, February 7, 1939; Capt. Edgerton L. Watson, from Hawaiian Department to Fort Slocum, N. Y.; Capts. Thomas C. Jones, Donald C. Kelley, Wayne D. Shipley, and 1st Lt. Walter T. Carll, from Washington, D. C., to Carlisle Barracks, Pa., January 13 (temporary); 1st Lt. Benjamin F. Leach, from Fort Sheridan, Ill., and temporary duty at Fort Knox, Ky., to Carlisle Barracks, Pa., January 13.

Appointment.—1st Lt. Karl Harry Willers, Veterinary Corps Reserve, as first lieutenant in the Veterinary Corps, Regular Army, with rank from November 1, 1938.

Assignment.—1st Lt. Karl Harry Willers, to Fort Oglethorpe, Ga.

Promotion.—To lieutenant colonel; Nathan M. Neate, Nov. 24, 1938.

Retired.—Col. Alfred L. Mason, Nov. 30, 1938.

Veterinary Corps Reserve

Correspondence Course in Forage Inspection.—Capts. Truman I. Means, New Mexico; Geo. S. Mechling, Ohio; Chas. H. Kitselman, Kansas.

New Acceptances—1st Lts. L. D. Boston, M. J. Durrant, J. A. Fitch, C. R. Hinson, W. E. Merritt, V. B. Robinson, J. G. Turner.

Separations.—Maj. Eugene L. Hannon, died Oct. 2, 1938; Capt. Walter E. Neary, died Nov. 6, 1938.

Promotions.—To captain: Morris E. Blostein; Robert M. Parker.

New Assignments to Active Duty with CCC.—1st Lt. Edgar W. Millenbruck.

Termination of Assignment to Active Duty with CCC.—1st Lts. W. H. Merchant, Karl H. Willers.

Laboratory for Investigating Fur Animal Diseases

A branch laboratory for research in fur animal diseases is being established at Pullman, Wash., under a cooperative agreement between the State College of Washington and the U. S. Biological Survey.

F. D. McKenney, of the Survey's Section of Disease Control, will be in charge of the laboratory. Arrangements for maintaining test animals at the college and facilities for disease investigations are being completed.

J. E. Shillinger, in charge of the Survey's Section of Disease Control, also announced the transfer of Don R. Coburn from the Bear River Migratory Bird Refuge, Utah, and the proposed addition of an assistant veterinarian, to the Bureau's new pathological laboratory at the Patuxent Research Refuge, near Bowie, Md. Doctor Coburn's disease investigations at the Bear River Refuge will be continued by E. R. Quortrop.

Veterinarians Wanted

There is a decided shortage of well trained veterinarians in the South. The livestock belt is definitely moving into Dixie and we are not training young men to protect these animals from parasites and disease. The State of Virginia has this year 2,183,000 head of livestock, exclusive of poultry, but only 81 veterinarians—less than one to a county. Many of these vets live in cities and towns and devote practically all of their time to pets—dogs and cats. Furthermore, two-thirds of our veterinarians are passed 50 years of age and will be ready for retirement within the next 15 years. Compare Virginia conditions with Pennsylvania, which has 2,934,000 head of livestock and 475 veterinarians in active practice.

As disease eradication campaigns progress, as our animals become better bred and more valuable, so will there arise even greater opportunities for students of veterinary medicine in the South. Where are these young vets coming from? We are not training them in Southern colleges of agriculture. There is only one Land-Grant College—Auburn, Alabama—from Philadelphia, Pennsylvania to Texas A. & M. College that offers complete training in veterinary medicine. Our Southern colleges and farm boys are overlooking a genuine opportunity.—*Southern Planter,* Richmond, Va.

Eff Builds New Research Laboratory

The Eff Laboratories, Inc., Cleveland, O., large producers of carotene products, have started construction on their new research laboratories on a three-acre plot adjacent to their present plant. The new building will be of brick and steel construction and will add approximately four times as much floor space to the existing laboratory. It will house a large scientific library with a separate room for current technical journals, reprints and other reference files, a large general laboratory with seven private laboratories devoted to organic synthesis, bacteriological research and physical measurement work. There will also be a photographic dark room and two separate dark rooms for colorimetric, ultraviolet and visual spectrophotometric work. Air conditioned biological and veterinary laboratories are located on the ground floor for assays and feeding tests with rats, guinea pigs, rabbits, chickens, dogs and monkeys.

All modern facilities for research work will be available. The new laboratory building will be ready for occupancy in 60 days.

Dr. Harry S. Lames, Dysart, Ia., has just erected a new animal hospital. Unlike most animal hospitals constructed recently it contains in addition to waiting room, office, surgery, kennels, autopsy room, etc., stalls for horses and cows.

GONADIN
increases lamb crop 21.2%

Three-hour twins from the injected group

EVIDENCE of the tremendous gonad stimulating effect of Gonadin is the report of O'Neal (North American Veterinarian, October, 1938).

A group of 430 Ramboulet quarter bred Lincoln ewes treated with one dose of Gonadin produced a 104.2% lamb crop as against 83% for the 296 controls in the same group and 70% for the entire band the previous year, under parallel conditions. As early lambs were desired, the ewes were brought into heat during the usual period of anoestrum, some six weeks prior to the usual breeding season. The rams were injected at the same time. Lambing started on October 18th and by December 1st—the date at which lambing had started the previous year—84% of the treated ewes had lambed.

Gonadin has a powerfully stimulating effect on the gonads of both male and female of all species. In consequence it is being widely used in the treatment of hypo-functioning gonads in individual cases. However, its greatest economic importance, as shown by the above report—the treatment of entire herds of livestock to increase the yield and regulate the breeding season—has been largely overlooked.

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Carotene Products by the gram or car

Dr. Albert J. Crane, Cornell '37, formerly of Glen Cove, L. I., has purchased the practice and hospital of the late C. P. Murry in Glens Falls, N. Y.

The annual meeting of the Tennessee Veterinary Medical Association will be held in Nashville, Tenn., on January 23 and 24, 1939, at the Noel Hotel.

In a test case the supreme court of Florida recently ruled that the Live Stock Sanitary Board in that state has authority to enter the premises of a cattle owner over his protest, test his cattle for Bang's disease and remove the reactors.

A new wax has just been introduced which, unlike most waxes, has the property of being sticky or adhesive. Waxes, in general, are characterized by their "slip" and poor adhesion to smooth surfaces. This new wax exhibits high adhesive properties even on glass and metals. It is amorphous or non-crystalline and thus has higher water-repellent properties than paraffin and other crystalline waxes. It blends easily with resins, oils and other waxes, the mixtures giving many unique results. It is being used for coatings, laminating work of all kinds and may prove serviceable as a coating for bandages. The product is known as Flexo Wax C, and is marketed by the Glyco Products Co., 148 Lafayette St., New York.

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Retired Army Veterinarian Dies

Maj. Daniel LeMay, 80, died in Montreal, December 28, 1938. Major LeMay was born at L'Abord a Plouffe, Quebec. He was graduated from the Montreal Veterinary College in 1879. Entering practice in Maryland in the latter year, he served as State Veterinarian in Maryland from 1880 to 1884. After another year of private practice in Kansas City, Mo., he entered the army veterinary service, serving in the cavalry until 1902 and in the artillery until 1916, when he was retired for physical disability. In 1917 he was again ordered to active duty, and was returned to retired status in 1919.

Army Veterinary Service

Transfers.—Col. George H. Koon, from Eighth Corps Area, Fort Sam Houston, Tex., to First Corps Area, Boston, Mass., and additional duty at the Boston Quartermaster Depot and at Harvard University, April 1, 1939; Lt. Col. Joseph F. Crosby, from Fort Devens, Mass., and temporary duty at First Corps Area, Boston, Mass., to the office of the Surgeon General, Washington, D. C., April 15, 1939; Lt. Col. Gardiner B. Jones, from Philippine Department to Fort Snelling, Minn.; Lt. Col. Daniel H. Mallan from Panama Canal Department to Langley Field, Va.; Lt. Col. Isaac O. Gladish, from Fort Sam Houston, Tex., to Philippine Department; Lt. Col. Jean R. Underwood from Army Medical Center, Washington, D. C., to Eighth Corps Area, Fort Sam Houston, Tex., March 15, 1939; Lt. Col. Nathan M. Neate, from Langley Field, Va., to Fort Knox, Ky., January 10, 1939; Lt. Col. Philip H. Riedel, from Fort Sam Houston, Tex., to Eighth Corps Area General Depot, Fort Sam Houston, Tex., and additional duty at Randolph Field, Tex.; Lt. Col. Raymond A. Kelser, from Washington, D. C., to Fort Robinson, Nebr., and Fort Reno, Okla. (temporary) for the purpose of investigating the prevalence of equine strangles and associated conditions and for the formation of plans for the control and prevention of equine encephalomyelitis. Col. Kelser has also been granted 12 days detached service for the purpose of attending the University of California Veterinary Conference at Davis, Calif., January 3-6, 1939, and a meeting of the Intermountain Livestock Sanitary Association at Salt Lake City, Utah, January 9, 1939; Lt. Col. Louis L. Shook, from Fort Bliss, Tex., to Fort Hoyle, Md., June 20, 1939; Maj. Verne C. Hill, from Fort Leavenworth, Kans., to Philippine Department, February 7, 1939; Capt. Maurice W. Hale, from Fort Sam Houston, Tex., to station hospital, Fort Sam Houston, Tex.; Capt. Richard C. Yule, from Fort Moultrie, S. C., and additional duty at Fort Screven, Ga., to Fort Leavenworth, Kan.

Appointment.—Capt. Frank Arnold Todd, Veterinary Corps Reserve, as first lieutenant in the Veterinary Corps, Regular Army, with rank from December 1, 1938.

Assignment.—1st Lt. Frank Arnold Todd to Fort Devens, Mass.

Promotion.—To captain, 1st Lt. Walter T. Carll, December 4, 1938.

Revocation of Order.—The order transferring Lt. Col. Jean R. Underwood from Army Medical Center, Washington, D. C., to Philippine Department, is revoked.

Veterinary Corps Reserve

New Acceptances.—1st Lts. T. E. Bonds, W. Z. Burke, W. M. Davidson, O. H. Jacobson, H. E. Kendall, C. L. McGinnis, A. L. Stigers.

Separations.—Capt. F. A. Todd (accepted appointment in Regular Army Dec. 1, 1938); 1st Lt. R. G. Elmore (died Sept. 2, 1938).

Promotions.—To captain, R. J. Steffen.

New Assignments to Active Duty with CCC.—Capt. L. A. Hock; 1st Lt. W. A. Anderson.

Termination of Assignment to Active Duty with CCC.—Capt. F. A. Todd; 1st Lts. J. D. Manges, R. V. Schoentrup, H. O. Sheetz.

Illinois State Meeting at Springfield

The 57th annual meeting of the Illinois State Veterinary Medical Association will be held at the Leland Hotel, Springfield, Ill., February 16 and 17, 1939.

Virginia State Board Examination

The Virginia Board of Veterinary Examiners will meet in Blacksburg, in February, for the examination of such candidates as may present themselves for license to practice. Veterinarians interested in this examination should communicate with the secretary, Dr. H. H. Adair, Bristol, Va., who will furnish the necessary application blanks.

1938 Chappel Award Won by Leonard Brumby

The Chappel award for the most distinguished service to dogdom during 1938 will be presented to Mr. Leonard Brumby, Hicksville, at the Westminster Dog Show in New York, February 13.

Winning the 1938 Chappel Award climaxes more than 30 years of active interest in dogs, during which time Mr. Brumby's integrity and organizing ability has gained the admiration of dog fanciers everywhere. His distinguished sportsmanship and untiring energy are an inspiration to all lovers of pure-bred dogs. Few dog enthusiasts have such an outstanding record as his.

GONADIN
increases lamb crop 21.2%

Three-hour twins from the injected group

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Progressive livestockmen among your clients will appreciate having this application called to their attention.

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Kansas State Meeting

The next annual convention of the Kansas Veterinary Medical Association will be held February 15 and 16 at Manhattan, Kansas, with headquarters at the Wareham Hotel. All sessions, both literary and clinic, will be held at the veterinary building at Kansas State College.

Veterinary Association Gets New Name

The Southern State Veterinary Medical Association held a very successful meeting in Knoxville, Tenn., Nov. 3-5, 1938. This, the 23rd annual meeting, was attended by veterinarians from 16 states. A new constitution and by-laws were adopted, and the name of the association was changed to The Southern Veterinary Medical Association. The new officers are: B. C. McLean, Aiken, S. C., president; Col. B. A. Seeley, Atlanta, Ga., 1st vice-president; M. Jacob, Knoxville, Tenn., 2nd vice-president; L. A. Mosher, Atlanta, Ga., secretary; and M. R. Blackstock, Spartanburg, S. C., treasurer.

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Mid-West Small Animal Association to Meet

The Mid-West Small Animal Association will hold an all-day clinic and meeting at Hotel Burlington, Burlington, Ia., Wednesday, March 8th. Doctors Haigler, Riser, Smith, LaCroix Jr., and Anders are to appear on the clinic and technical programs. The officers of the association are: J. H. Krichel, president; G. R. Clark, vice-president; and C. L. McGinnis, secretary-treasurer.

Army Veterinary Service

The army veterinary laboratory service prepared, during the fiscal year ending June 30, 1938, 1,492cc of antigens; 10,000cc of bacterins; 4,800 doses of intradermic tuberculin; 124,762 doses of mallein, and more than 20 thousand doses of various serums for the use of the army. The service also made many thousands of chemical and bacteriological examinations of food and pathological specimens.

The veterinary corps inspected, prior to or at the time of purchase, 163,614,427 pounds of meat and dairy products during the last fiscal year. Of this amount 8,702,984 pounds, having a monetary value of $488,303, were rejected. The major portion of these foodstuffs was reinspected one or more times during storage and at time of issue to the troops. Condemnations before or at the time of purchase amounted to 6%; at later inspections to only 0.03%.

Transfers.—Lt. Col. Allen C. Wight, from Fort Benj. Harrison, Ind., to Panama Canal Department, June 14; Capt. Edgerton L. Watson, from Hawaiian Department to Fort Hamilton, N. Y. (amended order).

Promotion.—To captain: 1st Lt. Frank A. Todd, with rank from December 1, 1938.

Veterinary Corps Reserve

During the fiscal year ending June 30, 1938, the Veterinary Reserve was increased by 262 officers, bringing the total to 1,332, 81% of the peace time procurement objective. In the same period the average number of veterinary reserve officers on active duty, assigned to Civilian Conservation Corps food inspection was 104. These officers inspected 207,998,925 pounds of meat and dairy products prior to or at the time of purchase for the CCC, of which 17,256,858 pounds were rejected. This represented a saving to the government of over three-quarters of a million dollars.

New Acceptances.—1st Lts. J. A. Butterworth, G. F. Scheetz, D. C. Vest, P. R. Yarbrough.

Promotions.—To captain: H. T. Mydland and R. J. Steffen.

Separation.—1st Lt. Harve Frank (died Aug. 2, 1934).

New Assignments to Active Duty with CCC.—1st Lts. L. W. Groves, W. W. Fechner, R. R. Younce.

Termination of Assignment to Active Duty with CCC.—1st Lts. Everett Anderson and Raymond Gathman.

World Renowned Preacher Talks About Dogs

Dr. Preston Bradley, Past National President of the Izaak Walton League of America, far-famed lecturer, author, educator and humanitarian, promotes the cause of dogs in the home as he premieres "Kennel Time", his new radio program, sponsored by Chappel Bros. Inc. It is aired over 17 major stations every Sunday morning.

F. M. Wilson of Mechanicsville was elected president of the Iowa Veterinary Medical Association at its 51st annual meeting in Des Moines Jan. 18-20, 1939. Guy M. Jones, Audubon, was chosen president-elect, W. A. Aitken, Merrill, 1st vice-president, A. R. Menary, Cedar Rapids, 2nd vice-president, and C. J. Scott, Knoxville, secretary-treasurer.

Deaths of Veterinarians

J. D. Kopp, Davenport, Nebr., Apr. 1, 1938; E. L. Hannon, 52, Pittsfield, Mass., Oct. 3; L. J. Benson, 49, Pawling, N. Y., Nov. 3; E. D. Wilder, 39, Hattiesburg, Miss., Nov. 23; L .H. Middaugh, 43, Memphis, Tenn., Nov. 25; Maj. Daniel LeMay, 80, Leavenworth, Kans., Dec. 28; W. H. Murphy, 61, Brookline, Mass., Aug. 7; T. W. Chandler, 83, Davenport, Ia., Aug. 11; G. A. Posse, 38, Tifton, Ga., Sept. 20; S. N. Chapin, 44, Battle Creek, Mich., Oct. 21; G. E. Hendren, Bethany, Mo.; W. E. Neary, 44, Watertown, S. Dak., Nov. 6; C. H. Goddard, 63, Pine Village, Ind., Nov. 15; N. T. Clark, 70, Valparaiso, Ind., Nov. 16; H. C. Rogers, Oskaloosa, Ia., Nov. 29; W. J. Brandewie, Kalispell, Mont., Nov. 30; W. H. Stephenson, 63, Stockton, Ill., Dec. 7; J. S. Andrade, Huntsville, Ala., Dec. 7; F. H. McClean, 50, Neoga, Ill., Dec. 8; H. A. Vetterling, 55, Huron, S. Dak., Dec. 11; James Harrison, 74, Buchanan, Mich., Dec. 13; C. H. Johnson, Grovertown, Ind., Dec. 15; J. W. Ireland, 77, Quincy, Ill., Dec. 17; S. H. Swain, 97, Decatur, Ill., Dec. 19; G. M. Lynch, 53, Sullivan, Wis., Jan. 1, 1939; V. W. Yates, 41, Memphis, Tenn., Jan. 3; W. S. Longacre, 66, Lehighton, Pa., Jan. 4; S. M. Springer, 77, Indianapolis, Ind., Jan. 12; Tait Butler, 76, Memphis, Tenn., Jan. 13; F. F. Parker, 63, Des Moines, Ia., Jan. 19; W. B. Niles, 83, Covina, Calif., Jan. 23; O. C. Alexander, 52, Springfield, Ill., Feb. 5.

No Medicinal Remedy Effective Against Bang's Disease

No drug or combination of drugs has yet been found effective in the treatment of Bang's disease, according to U. S. Department of Agriculture officials. Results of recent tests of two alleged Bang's disease remedies confirm previous experience with such products.

Conducted by trained investigators of the Federal Bureau of Animal Industry and the University of Wisconsin, the tests showed the products to be of no value as either preventives or cures. Chemical analysis of the alleged remedies also failed to disclose any ingredients likely to have any beneficial effect in combating Bang's disease.

Although no drug or medicinal compound has proved to be effective against the disease, steady progress is being made by systematic testing of herds, the removal and slaughter of diseased animals, and maintenance of proper sanitary conditions. This work is conducted cooperatively by cattle owners, State livestock officials, and the Bureau of Animal Industry, U. S. Department of Agriculture. In addition, officials engaged in control work report promising results from calfhood vaccination and, in some cases, from the use of approved methods of segregation combined with testing.

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For Encephalomyelitis

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These specialized laboratories are furnished with the very latest types of equipment. They are operated as two separate and distinct units—one engaged exclusively in producing the Eastern type vaccine, and one the Western type.

The finished vaccine is carefully tested for potency by means of live animal tests. All production steps are checked and double-checked in accordance with the rigid Fort Dodge standards of quality.

When you order Fort Dodge Chick Vaccine, you may do so with the knowledge that it is the finest that modern equipment and exacting, scientific methods can produce.

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	WESTERN TYPE	
BANJO	Pkg. 1 treatment (two 10-cc vials)	$1.50
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New York Skyline

Veterinary Exhibit at the New York World's Fair

In this complex modern age, veterinary science serves man in many ways besides protecting the health of domestic animals. Veterinary research work has made important contributions to human medicine. Veterinary inspection of meat and milk supplies is a valuable safeguard to human health. And the eradication of animal diseases and parasites makes stock raising more profitable, with resulting benefits to agriculture and industry.

To acquaint the public with these modern developments the veterinary profession will sponsor an exhibit at the New York World's Fair in 1939. "Veterinary Science and Public Health" is the central theme. Through this medium not only will important contributions made by live stock to our food supply and general comfort be portrayed, but emphasis will be placed on the vital part the veterinarian plays in human health. For instance, it will show that research conducted by veterinarians on the cattle fever tick first proved that insects carry disease. This discovery was the basis for controlling many human diseases such as typhus fever, yellow fever, and many others now known to be spread by insects.

The work done in eradication of bovine tuberculosis will be shown as a great aid to the safety of milk supplies.

An additional field of veterinary science is the modern hospital service now provided for pet animals, particularly dogs and cats. These companions of man may now receive treatment and care under highly favorable conditions. Veterinary practice in this field includes X-ray equipment, preventive vaccination, anesthesia, corrective surgery, special diets, and related services comparable to that of any modern hospital. The exhibit deals in part with these subjects of current interest to owners of pets and other domestic animals.

How well the Federal meat inspection serves the public will be graphically told. This service consists largely of rigid inspections by skilled veterinarians. Alert in recognizing symptoms of disease, they pass or condemn meat, as its condition demands.

The veterinary exhibit will occupy about 590 square feet of floor space in the Medicine and Public Health Building at the Fair.

In order to assure that such an exhibit would be presented for the enlightenment of visitors to the Fair, the veterinary profession and milk and meat interests of the country have coöperated in generously contributing both money and time.

Army Veterinary Service

Transfers—Lt. Col. Claude F. Cox, from Fort Des Moines, Ia., to Hawaiian Department, June 1, 1939; Lt. Col. Harry L. Watson, from Hawaiian Department to Fort Huachuca, Ariz.; Lt. Col. Ralph B. Stewart, from Fort Riley, Kans., to Army Medical Center, Washington, D. C., June 1; Lt. Col. George L. Caldwell, from the office of the Surgeon General, Washington, D. C., to Fort Riley, Kans., Aug. 19; Capt. Russell McNellis, from Army Medical Center, Washington, D. C., to Philippine Department, June 1.

Resignation.—1st Lt. Fred Lewis Herring, Feb. 10.

Veterinary Corps Reserve

New Acceptances.—1st Lts. Robert John Au and Willard Deere Ward.

Promotions.—To Lt. Col.: John A. O'Connell; to Major: Philip H. Fulstow; to Captain: Alta Roy Bruner; to 1st Lt.: Earnest Paul Bernard.

New Assignments to Active Duty with CCC.—1st Lts. Don C. Vest, Geo. G. Scheetz, Willard R. Merchant.

Termination of Assignment to Active Duty with CCC.—1st Lts. Samuel F. Ruber and Howard F. Carroll.

How many DOGS come to you MALNOURISHED?

The majority of canines that come to the veterinarian suffer from improper feeding. This may be a cause or result of their illness or debility. In either case they need . . . . . .

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Deaths of Veterinarians

A. G. Crump, Middleburg, Va., Dec. 29; R. N. Walsh, Huntington, Quebec, Dec. 31; J. O. Blackshere, 49, Charleston, W. Va., Dec. 24; George Strevel, 81, Bay City, Mich., Jan. 1; D. L. Clark, 57, Poultney, Vt., Jan 2; G. L. Sheldon, 68, Long Beach, Cal., Jan 3; F. H. Burgman, 59, Butte, Mont., Jan. 4; A. D. Gaylord, 63, Washington, N. J., Jan. 5; W. J. Ridgway, 72, Robinson, Ill., Jan 7; H. L. Switzer, 69, Willimantic, Conn., Jan. 11; J. G. Wetzel, 80, Bethel, Mo., Jan. 7; W. A. Fitzpatrick, 67, Mount Holly, N. J., Jan. 24; W. H. Pullen, 72, Greenwich, Conn., Feb. 1; E. S. Garr, 50, La Grange, Ky., Feb. 2; L. N. Dodge, 58, Watertown, N. Y., Sept. 29; W. W. Jakeman, 68, Halifax, Nova Scotia, Jan. 21; J. F. Schofield, 83, Port Chester, N. Y., Dec. 23; S. M. Meredith, 58, Oklahoma City, Okla., Jan. 21; J. C. Moody, 84, Mason, Mich., Jan. 28; R. A. Pearson, 66, Hyattsville, Md., Feb. 13.

Missouri Examination

The Missouri State Board of Veterinary Examiners will hold their next annual meeting at Jefferson City, Mo., Tuesday, June 20, 1939.—*H. E. Curry*, State Veterinarian.

HARLTON'S LIQUID BLISTER *and* FREE BOOKLET

Easy to apply. Saturate on with hand—no rubbing. Doesn't burn, set skin "on fire," kill hair, or scar. Head let down in few hours. No rest necessary in many cases. Vary application to produce just degree of counter-irritation needed. Diluted with oil, makes any strength liniment desired. FREE SAMPLE—a $1.00 bottle sent free postpaid upon request if you have never had one . . . . treats several cases. It doesn't pay to be without this convenient, effective and economical preparation; write for sample or mail order today. 4-oz. size, $1.00; 16-oz., $3.00.

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Fort Dodge Opens New Branches

Fort Dodge Laboratories, Inc., recently announced the opening of three new branch offices, each completely stocked and with up-to-date refrigeration facilities. They are located at: 29 West 11th Ave., Columbus, Ohio; 226 So. Madison St., Peoria, Ill.; and 310 Jackson St., Sioux City, Ia.

Anthrax Poster Issued

A poster on anthrax has been prepared by the Bureau of Animal Industry, U. S. Department of Agriculture. Pointing out that the disease is transmissible to other animals, and also is very dangerous to man, the poster emphasizes precautions to be taken in disposing of affected carcasses.

The pictorial portion of the new poster shows the characteristic appearance of a cow dead of anthrax. Accompanying text describes briefly the cause of the disease, distribution in the United States, seasonal occurrence, sources of infection, characteristics of the disease, prevention, treatment, and precautions to be taken. The poster measures 16 by 20 inches, and is printed on light cardboard. It supplements Farmers' Bulletin 1736, "Anthrax", as a means of familiarizing stock owners and others with approved means of combating this dangerous malady.

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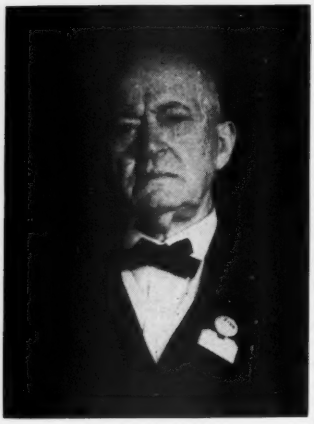
Iowa Veterinarian Dies



R. T. White, manager of the Cedar Rapids branch of the Corn States Serum Company, died March 22. Doctor White, who had been with the Corn States company since 1916, had the unique distinction of disposing of more anti-hog cholera serum than any other salesman. His acquaintance in the veterinary circle was large. Fifty veterinarians, many of them accompanied by their wives, attended his funeral. Doctor White formerly practiced at Anawan, Iowa.

Brandly to Lansing

Dr. C. A. Brandly, formerly associate chief of the Department of Animal Pathology and Hygiene, University of Illinois, has resigned to accept the position of Senior Veterinarian in the federal Regional Poultry Research Laboratory, East Lansing, Mich.

Army Veterinary Service

Transfers.—Lt. Col. Horace S. Eakins, from Fort Benning, Ga., to Third Corps Area, Baltimore, Md., and as attending veterinarian at Fort Howard, Md., and the Holabird Quartermaster Depot, May 15, 1939; Lt. Col. Frank H. Woodruff, from Third Corps Area, Baltimore, Md., to Fort Sill, Okla., May 15; Lt. Col. Charles O. Grace, from Fort Reno, Okla., to Fort Meade, S. Dak., May 15; Lt. Col. Edward M. Curley, from West Point, N. Y., to Fort MacArthur, Calif., June 1; Lt. Col. Elwood L. Nye, from Fort Meade, S. Dak., to West Point, N. Y., June 30; Capt. Charles S. Greer, from Fort Robinson, Nebr., to Fort Des Moines, Ia., May 1 (temporary) and to Fort Riley, Kans., Sept. 10; Capt. Bernard F. Trum, from Lexington, Ky., to Fort Robinson, Nebr., June 1; Capt. Daniel S. Stevenson, from the Philippine Department to Fort Reno, Okla.

Examination for Appointment in the Veterinary Corps, Regular Army

The War Department has announced a competitive examination to be held from July 24 to July 29, 1939, both dates inclusive, for the purpose of qualifying Doctors of Veterinary Medicine for appointment as first lieutenant in the Veterinary Corps of the United States Army, to fill contemplated vacancies.

Graduates of recognized veterinary colleges are eligible for the examination provided they are not less than 22 9/12 years of age at the time of examination and will not be over 32 years of age at the time it is possible to tender them a commission.

Complete information and application blank will be furnished any interested veterinarian upon request to The Adjutant General War Department, Washington, D. C.

To be considered applications for this examination must be received not later than July 1, 1939.

Veterinary Corps Reserve

New Acceptances.—1st Lts. R. J. Cyrog, Henry Donelson, G. S. Eversole, R. O. Moore, Jr., N. O. Wilson.

Promotions.—To captain: W. E. Dicke and W. R. Kerman. To 1st Lieutenant: E. P. Bernard and Emanuel Tarlow.

Illinois Association Holds 57th Meeting

The 57th annual meeting of the Illinois State Veterinary Medical Association was held at Springfield, Feb. 16-17, 1939, with approximately 300 veterinarians and their wives in attendance. Following the president's address a literary program was presented. The feature of the meeting was an address by H. D. Bergman, president of the American Veterinary Medical Association, on "Veterinary Medical Organizations," emphasizing the necessity of every veterinarian supporting his state and national associations.

The following officers were elected: W. B. Holmes, president; J. W. Lucas, vice-president; R. M. Carter, member of the executive board; C. C. Hastings, secretary-treasurer.

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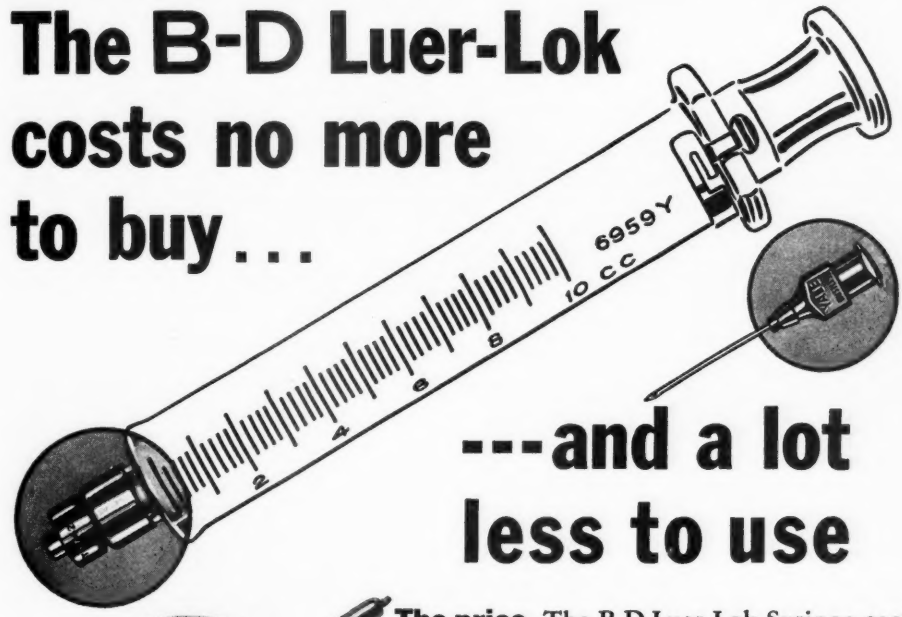

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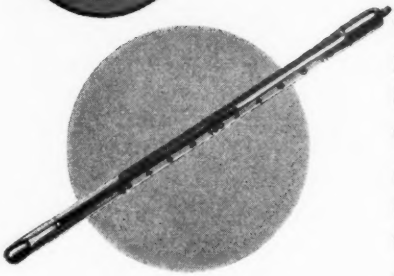

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TRUE or FALSE?

Statement. *A Veterinary Thermometer need not be as accurate as a human fever thermometer.*

False. Sick animals can't talk. A Veterinarian must depend on his judgment and his diagnostic instruments. Human patients that talk sometimes mislead M.Ds. An inaccurate diagnostic instrument will certainly mislead a Veterinarian.

B-D Veterinary Thermometers must undergo 70 operations, and survive 36 inspections and tests for accuracy and reliability before they are allowed to get into your hands.

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Free Sample. To Every Veterinarian that has not received a sample, we will gladly send postpaid a liberal sample upon request. No obligation.

DETROIT VETERINARY SUPPLY CO.
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Illinois Veterinarian Dies

The death of W. J. Ridgway, of Robinson, Illinois, occurred early in January. Doctor Ridgway was born at Oaktown, Ind., in 1866, and was graduated from Indiana Veterinary College in 1899. He practiced at Robinson for 32 years. From 1929 to 1938 he served as State Tuberculosis Inspector. He is survived by his widow and by two sons, James and Ray Ridgway.

Kansas Veterinary Medical Association

The Kansas Veterinary Medical Association held its 35th annual convention in Manhattan, February 15th and 16th, at the Division of Veterinary Medicine, Kansas State College.

The following officers were elected: president, J. A. Bogue, Wichita; vice-president, Roy L. McConnell, Coffeyville; board of directors, Sam Hayes, Hutchinson; secretary and treasurer, Chas. W. Bower (reëlected). Topeka was chosen for the next meeting.

In Japan, when a dog barks at night, his owner is sentenced to work for those whom it disturbed.

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Subjected to a 35 Day Potency Test

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All Homologous serum (Kinsley) offered for sale, is tested for potency on Police puppies. These puppies are kept in direct contact with typical cases of distemper for the entire test period of 35 days.

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For the convenience of our Eastern customers, the Standard Veterinary Products Company, 16 East 23rd St., New York, New York, are our distributors. We will appreciate your patronage through them.

For results, use Sero-Toxylin

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Ohio State Veterinary Conference

The Twelfth Annual Conference of the College of Veterinary Medicine, The Ohio State University, will be held June 14, 15, 16, 1939. The program is quite an extensive one and includes some of the foremost veterinarians and educators in this country. The entire three day period will be devoted to the discussion of topics of vital importance to every veterinarian. A special effort has been made in arranging the program so that its quality and variety will appeal to all veterinarians, and all are invited to attend.

Oscar V. Brumley

Programs of the conference will be ready for mailing in the near future and will be sent to any veterinarian on request. You will observe in looking it over the names of many nationally known experts in their specific lines of work, assuring you of an excellent and instructive program during the entire period. Everything possible will be done to make your attendance at this conference pleasant and profitable.—*O. V. Brumley.*

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DAIRMOL DUSTING POWDER FOR GRANULAR VAGINITIS

Antiseptic **Astringent**

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Careful study indicates the best method of application to be that of spraying the dry powder evenly over the walls of the vagina by means of a Powder Blower designed according to our specifications. Over 400 outfits in use among prominent veterinarians.

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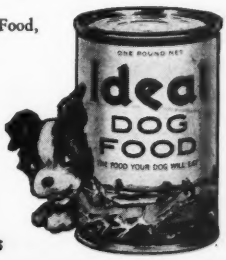

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A safe and dependable treatment for Spider Teats, Scab Teats, Cut and Bruised Teats, Obstructions and for keeping teat canal open after operating.

Dr. Naylor Dilators fit either large or small teats without overstretching or tearing, are easy to insert and stay IN the teat. They carry antiseptics and healing agents into teat canal to combat infection and promote healing. The dilators themselves are Sterilized, Soft, Absorbent dressings which protect the inflamed area, absorb inflammatory exudates and keep teat canal open in its natural shape while tissues heal.

Price to Veterinarians

Dollar Package (contains 48 Dilators).....$8.00 Per Doz.
Fifty Cent Package (contains 18 Dilators)..... 4.00 Per Doz.
←Plain Dispensing Package (contains 15 Dilators)..... 3.00 Per Doz.

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Houston Veterinarians Meet

At the regular monthly meeting of the Houston Veterinary Association, March 2, 1939, the following officers were chosen: Madero N. Bader, president; Don B. Strickler, vice-president; W. T. Hufnall, secretary; J. Gilbert Horning, corresponding secretary.

An article on the Common Dog Flea was read by Doctor Horning, and Dr. William James showed an interesting movie on the proper technique for de-skunking a skunk or, in other words, removing the musk sacs of a pole-cat. Doctor Strickler was the first prize winner on the monthly questionnaire.

Deaths of Veterinarians

G. B. Hartke, Cincinnati, O., Jan. 29; J. E. Gibson, 77, Indianapolis, Ind., Feb. 10; L. A. Cottrell, 46, Waterville, Minn., Mar. 4; R. T. White, Cedar Rapids, Ia., Mar. 22; A. W. Graves, 41, Union, S. C., Mar. 24.

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Lest We Regret

Is experience the best teacher?

Where automobile accidents are concerned, experience is the best teacher only when it is somebody else's experience, according to a new booklet entitled "Lest We Regret," just issued by The Travelers Insurance Company. The booklet presents a comprehensive analysis, based on official reports from the 48 states, of the facts about accidents in which 32,000 persons were killed and more than a million were injured last year.

"The experience of losing his life is wasted on the driver or pedestrian killed in an automobile accident," the foreword states. "The experience of months in a hospital cot or of weeks in a law court is costly tuition for one's education in safety. If we wish to avoid these dire costs, we must apply the experience of others to ourselves."

Automobile Accidents Analyzed

The experience of the thousands who had to learn their lesson "the hard way" in 1938 brings to light many interesting facts such as the following:

Exceeding the speed limit was responsible for 39.6% of the deaths and 25% of the injuries. Despite a decrease in fatalities in 1938 compared with 1937, the percentage caused by speed went up.

Almost 94% of the drivers involved in fatal accidents were male and only 6% female.

More than 84% of the fatal accidents occurred in clear weather, and 77% happened when the road surface was dry.

More persons were killed on Sunday than on any other day of the week, while the heaviest injury toll came on Saturday. More persons were killed between seven and eight p. m. than at any other hour.

Almost 43% of all victims of fatal traffic accidents were pedestrians. Almost half of all pedestrians killed were either crossing between intersections or walking on rural highways.

"Danger Unit" Introduced

In addition to the statistical analysis, the booklet introduces a new and unique concept of driving danger in terms of "Danger Units." It is pointed out that energy increases progressively as the speed of a car increases, but that the increment in energy far outstrips the addition in miles per hour.

Taking as its equivalent the average shock limit of the human body, the Danger Unit is mathematically equal to the energy developed in an automobile moving at 25 miles per hour, to a street-width of actual stopping dis-

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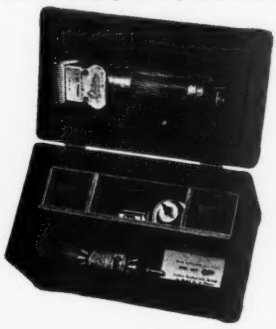

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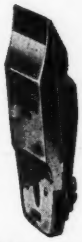

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A tabular list of the subjects discussed in this history includes:

Short account of veterinary medicine from dawn of civilization to the present.
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Veterinary medicine in America before the Civil War.
Veterinary medicine during the Civil War and post war period.
The founding and growth of veterinary colleges.
The development of veterinary practice during the nineteenth century.
The struggle for army veterinary legislation.
The enactment of veterinary practice laws.
The growth of a veterinary literature in the United States.
The long struggle for higher standards of veterinary education.
Many biographical sketches of veterinarians who have influenced the development of veterinary medicine in the United States and Canada.
The origin, growth and achievements of veterinary research.
A veterinary history of the Spanish-American War.
A history of the veterinary service in the United States during the World War.
A history of the U. S. veterinary service in France during the World War.
An account of the Veterinary Corps schools during the World War.
A record of veterinary laboratory service during the World War.
A record of veterinary food inspection during the World War.
A description of the present Veterinary Corps of the United States Army.
Halftone illustrations of prominent veterinarians since 1850.
Halftones of more than a thousand veterinary officers of the World War.
Illustrations of buildings and equipment of present and past veterinary colleges.
An account of veterinary associations and their achievements.
History of each of the present veterinary colleges, with buildings, deans, entrance requirements, course, graduates by years and prominent alumni.
History of organized veterinary medicine in the United States.
A large number of halftones showing places, individuals and groups of veterinary interest.
Special chapters by: Drs. C. J. Marshall, C. E. Cotton, F. H. Davis, J. P. Turner and W. H. Wright.

Including reference matter as follows:

List of foreign veterinary colleges, with dates founded.
List of veterinary colleges in North America, with dates founded.
List of state veterinary associations with dates founded.
List of officers and meetings of U. S. V. M. A., with dates.
List of officers and meetings of A. V. M. A., with dates.
List of army veterinarians prior to 1916, with service record.
List of veterinary officers (2313) during the World War, with service record.
List of Veterinary Hospitals of the World War and their C. O.'s.
List of Division Veterinarians during the World War and their assignments.
List of officers in present Veterinary Corps.
List of Veterinary Reserve officers.
Official Documents of the World War of veterinary interest.
List of veterinary books published in this country, 1793-1861.
List of veterinary books published in this country, 1861-1900.

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tance, to one "roll-over" in case of an accident, or to the fall of a person off a two-story house. This concept, coupled with the known fact that the energy of a moving body increases as the square of the speed, is illustrated in word-pictures clearly understandable even to persons whose knowledge of physical laws or of engineering is limited.

High Speeds Costly

Also contained in the booklet is a discussion of the high cost of fast driving. An increase in average speed from 35 to 45 miles per hour will save a little more than six hours of time in each thousand miles driven, it is shown, but each of the hours saved costs about 65 cents. An increase in average speed from 35 to 55 miles per hour jumps the cost of hours saved to about $1.20 each.

The insurance company will distribute two million copies of the booklet this year in the interest of highway safety. Single copies or quantities are available through the company or any of its agents.

"Corn States" Calendar

The 1939 edition of the "Corn States" calendar is both distinctive and interesting. In pictorial form are portrayed the material and technical changes which have marked the progress of virus-serum production during the 25-year period following the basic Dorset-Niles-McBryde discoveries, as well as the extent of plant development and technical procedures in current-day production. The colored art picture, "The Spirit of Youth," symbolizes the spirit in which the next 25-year period is being approached.

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Army Veterinary Service

Appointment—1st Lt. Don Lee Mace, Veterinary Corps Reserve, as first lieutenant in the Veterinary Corps, Regular Army, with rank from April 7, 1939.

Assignment.—1st Lt. Don Lee Mace, to Edgewood Arsenal, Md.

Transfers.—Lt. Col. Peter T. Carpenter, from Fort Robinson, Nebr., to Fort Logan, Colo., and as attending veterinarian at Fitzsimons General Hospital and Lowry Field, Denver, Colo., June 25; Lt. Col. Wm. R. Wolfe, from Fort Logan, Colo., and additional duty as attending veterinarian at Fitzsimons General Hospital and Lowry Field, Denver, to Fort Robinson, Nebr., June 25; Capts. Walter T. Carll, Thomas C. Jones, and Wayne D. Shipley, from Army Medical Center, Washington, D. C., and temporary duty at the Medical Field Service School, Carlisle Barracks, Pa., June 10, to Fort Riley, Kans., Front Royal, Va., and Fort Moultrie, S. C., respectively; Capt. Donald C. Kelley, from Army Medical Center, Washington, D. C., and temporary duty at the Medical Field Service School, Carlisle Barracks, Pa., to Fort Bliss, Tex., July 20.

Examination for Appointment in the Veterinary Corps, Regular Army

A competitive examination will be held July 24-29, 1939, for the purpose of qualifying Doctors of Veterinary Medicine for appointment as first lieutenant in the Veterinary Corps of the United States Army. Any graduate of a recognized veterinary college is eligible to take the examination, if not less than 22 9/12 years of age at the time of the examination, nor more than 32 years of age at the time it is possible to tender him a commission.

Applications for this examination must be received not later than July 1, 1939. Complete information and application blank will be furnished any interested veterinarian upon request to The Adjutant General, War Department, Washington, D. C.

Veterinary Corps Reserve

Promotion.—To captain: John Harvey Shoemaker.

Separations.—Capt. Clyde Wilton Picht, hon. discharged March 25, 1939, because of physical disability; 1st Lt. Don Lee Mace, accepted appointment in Veterinary Corps, Regular Army, April 7.

New Assignments to Active Duty with CCC.—1st Lts. David Ehrlich, Absolom Berry Rich, Jr., Darrell Bernard Sprott.

Termination of Assignment to Active Duty with CCC.—Milton W. Firestone.

Students Attend Houston Meeting

The entire senior class of the School of Veterinary Medicine, A. and M. College of Texas, attended the monthly meeting of the Houston Veterinary Association May 4 under the tutelage of Dean R. P. Marsteller. H. L. Van Volkenberg, of the Texas faculty, addressed the meeting on "Species of Helminth Parasites Found in Domestic Animals of Texas."

The Northwest Veterinary Medical Association will hold its annual meeting July 10, 11, and 12, at Seattle, Wash., with headquarters at the New Washington Hotel. This comes at a convenient time for eastern and midwestern veterinarians planning a trip to the San Francisco fair, who will enjoy a stopover at the Seattle meeting.

Nebraska Clinic

The annual clinic of the Nebraska Veterinary Medical Association will be held in Columbus June 22nd. A very large attendance is expected. For further information address Dr. H. C. Goeteke, Columbus, Nebr.

State Board Examination

An examination for license to practice veterinary medicine in Missouri will be held at Jefferson City June 20, 1939. For further information address H. E. Curry, State Veterinarian, Jefferson City, Mo.

Chemical Publishing Co., Inc., 148 Lafayette St., New York, N. Y., recently issued a new 36-page catalog of technical books, covering domestic and imported books on chemistry, physics, mathematics, medicine, metallurgy, machinery, engineering, biology, general science, business, manufacturing, formularies and technical dictionaries. A copy will be sent to anyone interested, on receipt of stamps to cover postage.

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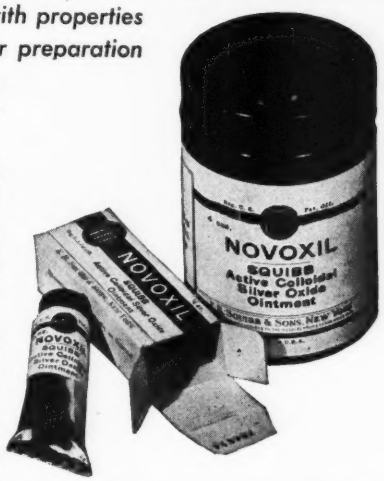
Case No. 1. Ulcer—Large Pomeranian 5 years old. Ulcer size of half dollar, right side of face; 3 to 4 months' duration. Owner, a physician, called attention to the fact that he had used a number of indicated remedies with no result. The daily application of NOVOXIL re-established granulations and complete healing occurred in several weeks.

Case No. 2. Cervicitis—Jersey cow about 6 years old. History:—This cow was from the average farmer's herd, with nothing more known about her other than she had calved the previous spring some (6 mos.) time before treatment was started. Owner said she had been bred numerous times to two different bulls and contemplated butchering her. He was advised to call me when she was in heat and Cervicitis was revealed. Large floculi of pus or islands of pus in secretion of vagina denoting pronounced Cervicitis. Treatment:—Consisted of 2 applications of NOVOXIL by using dressing forceps and cotton dipped in NOVOXIL and then swabbing cervical canal. This was done twice during heat periods at intervals of about 21 days. Instructions were to owner to breed cow at following (3rd) heat. This was done and cow conceived at first breeding.

Case No. 3. Lacerated Infected Wounds—German Shepherd 2 years old. Badly infected lacerating and penetrating wounds of several days' duration result of a dog fight. Treated with NOVOXIL. Established granulations in a satisfactory manner with complete healing in one week.

(References on request)



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K. S. C. 1939 graduate wishes to work in with retiring practitioner, or hear of any opportunity in veterinary profession. Address Box X, Kansas State College Post Office, Manhattan, Kans.

YOUNG VETERINARIAN desires position. Experience teaching, demonstrating small animal medicine, surgery; general practice including tuberculosis, Bang's, pullorum testing; dressed poultry inspection; dairy inspection, bovine physical examinations; laboratory work—toxin, toxoid, antitoxin production. Distance no objection. Address No. 245, care of VETERINARY MEDICINE.

WANTED: Summer employment with practitioners, with either small or large animal clientele, by advanced veterinary students of Michigan State College. Address: Aubrey Larsen, Lansing, R. R. 2, Mich.

WANTED: By Spring graduate, position with West Coast practitioner, or opportunity for practice in western area. Address No. 248, care of VETERINARY MEDICINE.

WANTED: Veterinary opening for senior student graduating from Kansas State College June 1. Excellent references. Work with a future desired. Address College P. O. Box 211, Manhattan, Kans.

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Balkan Medical Union Issues Manifesto

The Balkan Medical Union, an organization of doctors in the Balkan states which has as its aim the coalition of scientific men of all nations into a compact block capable of opposing the misunderstandings which engender hate and disastrous struggles between nations, recently voted the following manifesto, addressed to the doctors of the world:

The Balkan Medical Union, in session at Istanbul, for the fifth Medical Week,

having taken into consideration the terrible sufferings which a world war will bring upon the civil population of open towns, together with the total lack of any adequate means of protection,

and having discovered that even in its restricted form the project of "exempted towns" has not yet been adopted, and that all efforts made to protect civilians against chemical warfare have till now remained as proposals only, and that even the protocol prohibiting the use of asphyxiating gas has not yet been ratified by all nations,

has therefore decided to address itself to doctors of every nation with an appeal to take active measures and to fulfill this professional and humanitarian duty of awakening and stirring public opinion.

The Balkan Medical Union believes that only enlightened international opinion can make plain the imminence of the danger and the proved uselessness, even for the victor, of these terrible atrocities, and can thus lead to effective action.

The immutable truth that

hate breeds only hate, and atrocity breeds vengeance must be impressed on everyone.

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Newsom Recovering from Serious Illness

I. E. Newsom, dean of the Division of Veterinary Medicine, Colorado State College, Ft. Collins, who has been incapacitated with a heart involvement (coronary occlusion), is convalescing at Palm Springs, California. He expects to return to the college about June 1.

C. R. Roberts, N. Y. S. V. C. '22, Leonia, N. J., has been elected a director of Sheffield Farms Company, Inc., distributors of milk in the New York area. Doctor Roberts joined the organization in 1925 as a supervisor of milk inspection, and is now assistant to the vice-president of the company.

Prominent Texas Practitioner Dies

Dr. T. O. Scott, better known as "Tom" Scott by his wide circle of veterinary friends, died at Waco, Texas, March 30, 1939. Doctor Scott was born in Jasper, Texas, in 1883, and was graduated from the Kansas City Veterinary College in 1912. Since that time he has been engaged in practice in Texas, except during a period of overseas service in the World War. He is survived by his widow, three brothers, and two sisters.

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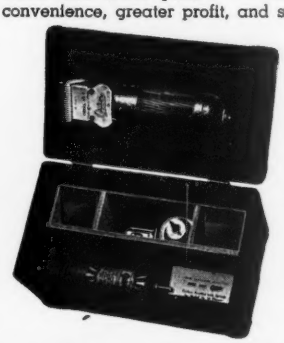

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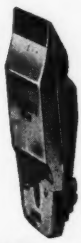

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MEMPHIS

Henry Asmus Dies

Prof. Henry Asmus, 64, outstanding authority on farriery, died suddenly March 1. Prof. Asmus, who had taught farriery for the last 26 years at New York State Veterinary College, was the last professor of this subject in the veterinary colleges of America.

Mr. Norman A. Buttle, formerly president and vice-president, and since 1934 treasurer of Winthrop Chemical Co., Inc., died April 17, 1939. Mr. Buttle was one of the founders of the company in 1919.

Southwestern Iowa Meeting

The 14th semiannual meeting of the Southwestern Iowa Veterinary Medical Association was held at Council Bluffs, Ia., April 4, 1939, with 100 veterinarians and their wives in attendance. The literary program consisted of a series of ten-minute talks with a five-minute discussion period. Dr. George Wessels, Creston, was toastmaster at the banquet, and Dr. R. Fred Eagle, vice-president of Wilson & Co., Chicago, the principal speaker. Dr. T. W. Gidley, Malvern, is president of the association.

Pig Problems

Are becoming more confusing in some localities because of the prevalence of anemia, infectious necrotic enteritis, dysentery, swine erysipelas, flu, hemorrhagic septicemia, pulmonary oedema and parasitism. Not infrequently, two or more of the diseases enumerated occur simultaneously and a field diagnosis is not possible, and treatment is problematic.

If practitioners that are having difficulty will send specimens of lung, heart, lymph glands, spleen, kidney and portions of diseased intestine, stomach, or other organs involved, packed in sufficient borax to absorb all moisture, laboratory examinations will be made without charge and the findings reported promptly.

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Dogs Through the Ages

As far back as the dim trails of time lead, we find the indelible footprints of the dog.

In the Book of Job, said to be the oldest writing extant, the dog, already domesticated, is mentioned more than once as the trusted guardian of the flocks. Exodus II, 17, tells us that when the children of Israel departed from Egypt with their families, cattle and other possessions, amid all the commotion—and what a commotion it must have been—not a dog lifted his tongue against them.

Every nation has its treasure house of dog lore, legends, proverbs and fables.

The brightest star in the skies is Sirius, the dog star, so named for its faithfulness, and absolute dependability. The oldest known monument on earth is the "dog's monument" built to honor the memory of a dog who after striving vainly to prevent his shepherd friends from eating poisoned porridge gulped it down himself, dying immediately.

One of the famous dogs of mythology is "Cerberus," the triple-headed dog of Pluto, who stands guard at the gate of the infernal regions. Then there is the dog of Ulysses who died of joy upon the return of his master after a prolonged absence. Also the fabled dog who stood guard over the seven sleepers, and through all the years never moved, ate, nor slept.

Among Indians the Pottawatomies believe that in the moon is an old woman weaving a basket,

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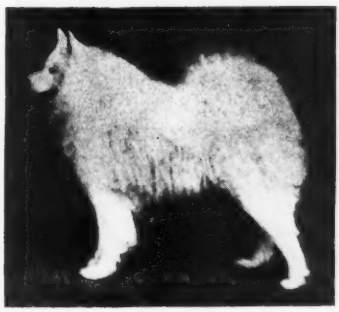

Champion Prince Kofski

Best of Breed at Western Kennel Show, Cleveland, March, 1939. Also placed in the Working Group at the same Show, which is unusual for a Samoyede. Best of Breed at International Kennel Club Show, Chicago, April, 1939. "His magnificent coat is a result of Vitality Dog Foods," say the owners—Mr. and Mrs. S. K. Ruick, Indianapolis, Ind.

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and that the earth will be destroyed when the basket is finished; but a great dog ruins her work at intervals.

The Aztecs sacrificed a red dog to carry the soul of the king across a deep stream and announce his arrival. The Iroquois kill a white dog in January as a scapegoat. It is then burned and the ashes sprinkled at every door.

Spartan Ephebi offered a young hound to the war god before going forth to battle.

A dog of Parian marble was placed on the tomb of Diogenes, and in the splendid sepulchers of ancient monarchs, amid treasures of fabulous value there is sure to be the image of a dog, a statue, or likeness carved on the wall, and so on down through the ages.

Even in this age of materialism, gone mad, every daily paper carries one or more items concerning dogs—some act of incredible heroism or devotion. Who is not familiar with the story of "Greyfriar's Bobby?" and the pioneer's dog whose master, crossing the continent with a covered wagon caravan died on the way and was buried on the "lone prairie" far from any human habitation. The faithful dog refused to leave unguarded the grave of his friend and remained with it, facing certain death from starvation and thirst. What were his thoughts as he watched the caravan fading into the distance? Whatever they were, the dog remained steadfast and died upon the lonely grave.

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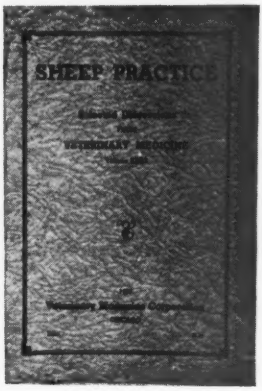

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unfold will the nobility, self-sacrifice, and loyalty of the dog be fully known.

"Dogs show as mortals seldom do, a high ideal of being true."—*David Lee Wharton* in *Our Dumb Animals.*

Horses and Mules in Germany

Germany has three and one-half million horses and practically no mules (less than 2,000), according to Dr. Gustav Rau of Berlin, who is one of the best informed and most noted horsemen in all Germany. He stated in conversation with Wayne Dinsmore, of the Horse and Mule Association of America, that horse breeding was increasing in Germany: that the German army had 100,000 horses in use now in artillery and cavalry, and was giving especial attention to producing a strong, active, durable artillery horse that would do for farm work and be suitable for war service.

Russia had about 17 million horses before the World War, but the number is now about 7 million, less than half, due to unwise measures followed there. The Russians are now awake to their folly and have been buying heavily of breeding stock in East Prussia, France, Ireland and England within the past three years: but it will take 20 years or more to undo the damage done in the last 20, according to Dr. Rau.

Poland is one of the best horse breeding countries in Europe, in Dr. Rau's opinion. Their people

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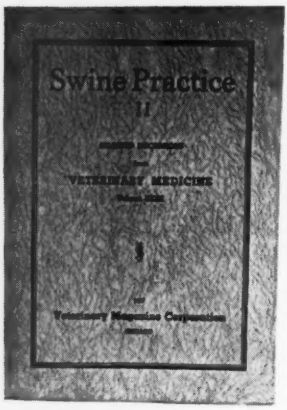

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love horses, and have made consistent efforts to improve the stock for both cavalry and artillery. He thinks they have the best, and most, Arabians of any country in Europe, which they have used successfully in crossing on Thoroughbred mares for the production of Anglo Arabs: but Dr. Rau says the experience in France, where they have been breeding such crosses for the last 75 years, has indicated that it is impossible to fix the type by breeding the halfbreds together, and that the wisest plan is to breed the halfbred fillies back to either an Arabian or Thoroughbred sire.

Grade draft horses predominate on the farms of Germany, said Dr. Rau, and Belgian sires are almost the only draft stallions used. Farmers who operate their own farms with mares raise most of Germany's horses, and stallions are quite generally used for farm work.

Gas costs five times as much in Germany as in America, the result being that but few tractors are found on German farms—less now than when they were first introduced, according to Dr. Rau.

New X-Ray Viewing Box Perfected

Mr. Morris Kurtzon, president of the Mt. Sinai Hospital, Chicago, has perfected a new type of x-ray viewing box, which utilizes fluorescent daylight lamps, thus preventing cracking of the film and affording greater visibility with a maximum amount of light distribution although using little current.

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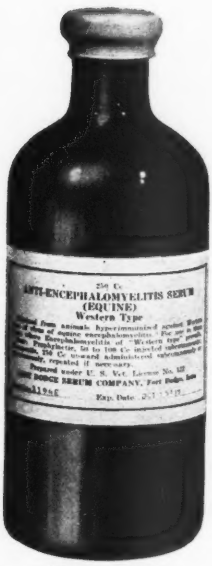

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Meeting of Virginia Examiners

The Virgmia State Board of Veterinary Examiners will hold an examination for those desiring to qualify for practice in that state, at 9 a. m., July 12, 1939, at the Monticello Hotel, Norfolk, Va. Application blanks and other particulars may be obtained from the secretary, H. H. Adair, Bristol, Va.

Indiana Examiners to Meet

The next examination for license to practice veterinary medicine in Indiana will be held July 11, 1939, in Rooms 209-210 State House, Indianapolis. Inquiries pertaining to this examination should be addressed to J. L. Axby, Secretary, Room 209 State House, Indianapolis, Ind.

New York State Seniors Attend Field Demonstration

A field demonstration of tuberculin testing, tagging, branding, slaughtering and conducting post-mortem examinations of reactors according to state and federal regulatory methods was held May 10th at Cortland, N. Y., for the benefit of the senior class of the New York State Veterinary College at Cornell University.

The students, instructors and officials assembled at Peter Camp's abattoir, a small but modern, sanitary establishment with adequate pens and equipment, located out in the country.

Not more than five students were assigned to each of the instructing veterinarians, who took their classes into the pens and demonstrated the technique of injecting, diagnosing, tagging, branding, drawing blood and preparing concise reports according to the uniform methods and rules adopted by the state and federal officials for tuberculosis and Bang's disease official testing.

Next the chief cattle appraiser gave a demonstration on how to arrive at a true value of a purebred or grade animal that has been condemned, and how to determine their salvage values. Post-mortem examinations of reactors were conducted by two official veterinarians, assisted by the students. The morning program was concluded with a talk on federal meat inspection by a U. S. Inspector in Charge, with a display of pathological and parasitic specimens commonly observed on a killing floor in this locality.

The afternoon program was devoted to short addresses by state and federal officials for the purpose of getting acquainted, so that the graduating seniors, when they get into practice, will feel free to bring their problems to the officials. H. M. O'Rear, Tuberculosis Eradication Division, Washington, D. C., talked on the national phase of tuberculosis and Bang's disease. W. J. Embree, agricultural representative of the N. Y. Central Railroad System, Columbus, O., gave a talk illustrated with movies showing the losses incurred from improper handling of live stock in transit. Frans C. Goble, pathologist for the Conservation Department, Albany, N. Y., displayed a number of pathological specimens of diseases occurring in wild birds and animals, and explained their relationship and danger to domestic animals.

This demonstration, an annual affair, was started seven years ago; as the years have progressed, the project has grown to the point where it is almost impossible to cover all the subjects in one day. In addition to the students for whom it is primarily intended, graduate veterinarians from the surrounding area have been attracted to the demonstration. A great deal of preparation is required, but the enthusiasm and coöperation with which the project has been received amply justify the effort.—*H. B. Leonard.*

L. Enos Day Dies

L. Enos Day, secretary of the U. S. Live Stock Sanitary Association, died of a heart attack at his home in Chicago, May 19, 1939. Doctor Day was born at Melbern, Ohio, June 20, 1865, and was graduated from the Ontario Veterinary College in 1892. After five years of general practice in Kansas, he entered the service of the federal government, and in a short time became head of the Chicago laboratory of the Pathological Division of the Bureau of Animal Industry of the U. S. Department, retiring from that position in 1935.

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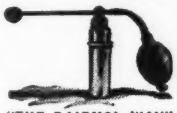

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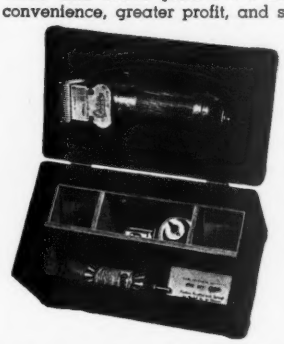

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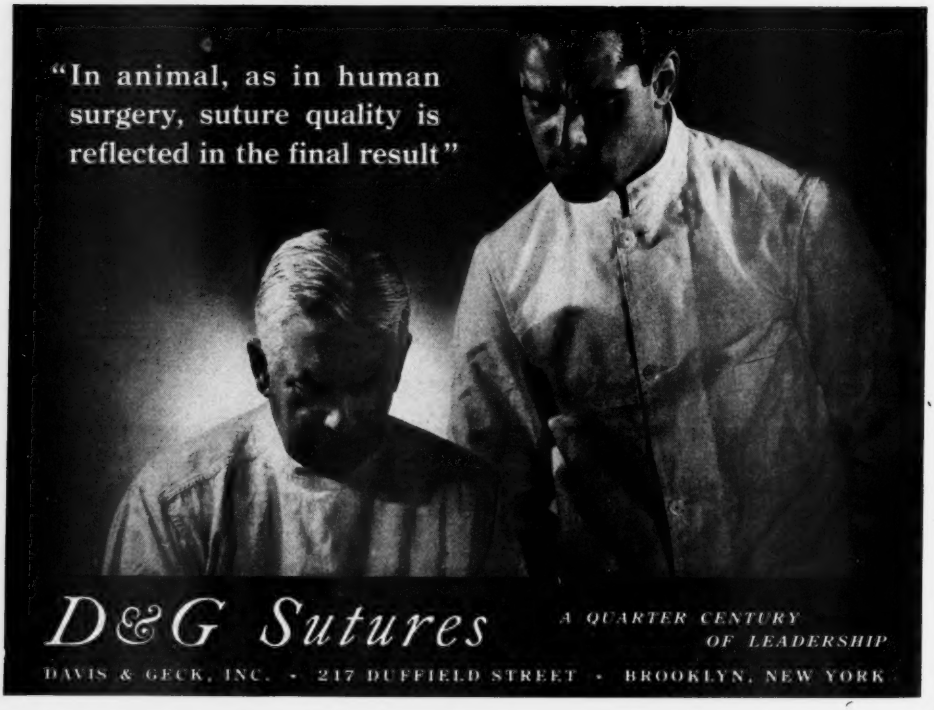
Cameron New Veterinary Director General

A. E. Cameron, ONT '08, was appointed Veterinary Director General of Canada May 1, 1939, succeeding Dr. George Hilton, who retired last year. Doctor Cameron came from Scotland at an early age and homesteaded in Saskatchewan. Following his graduation he joined the Health of Animals Branch, being stationed first at Winnipeg, Manitoba, and later in Saskatchewan. During the World War he served in France with the Mobile Veterinary Unit and was decorated with the Military Cross. After the war he was placed in charge of the Government Experimental Station in Lethbridge, Alberta, and later became Chief Veterinary Inspector in charge of the Animal Disease Control Division at Ottawa. Doctor Cameron represented Canada on the executive committee of the A. V. M. A. for many years, and served one term as vice-president of that organization.

Dr. A. E. Bott, East St. Louis, Ill., has received much favorable notice recently in the newspapers of his city because of his policies for the conduct of the schools and his reorganization of the board of education. Doctor Bott was elected president of the board of education at the April election.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Breed Receives Rhode Island Appointment

Granville W. Breed, CHI '18, was appointed Director of Agriculture and Conservation for Rhode Island, March 29, 1939. Doctor Breed entered the B. A. I. service in 1927, being stationed in New Hampshire on tuberculosis eradication until 1933, when he was transferred to Rhode Island.

Kelser Participates in Harvard Short Course

The Faculty of the Harvard School of Public Health is offering a short course of lectures, clinics and demonstrations on the virus and rickettsial diseases, with special emphasis on their public health significance, during the week of June 12-17, 1939. Lt. Col. Raymond A. Kelser, Chief of Veterinary Division, U. S. Army, is scheduled for two half-hour lectures; Distemper in Animals and Epidemiology and Prophylaxis of Rabies.

Elmer F. Kinsley, KC '11, Laramie, Wyo., died May 7th from a heart attack. The *Laramie Republican* (May 9) mentioned his passing, editorially, under the caption "A Friend of Animals—and Men." The deceased was a brother of Dr. A. T. Kinsley, Kansas City. Mo.

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New Jersey Veterinary Meeting

The 55th semi-annual meeting of the Veterinary Medical Association of New Jersey will be held at the Hotel Berkley-Carteret, Asbury Park, N. J., July 13-14, 1939.

Army Veterinary Service

Transfers.—Lt. Col. Burlin C. Bridges, from Hawaiian Department to Fort Bliss, Tex.; Lt. Col. Kenneth E. Buffin, from Carlisle Barracks, Pa., to Hawaiian Department, Aug. 15; Capt. Stephen G. Asbill, from Presidio of Monterey, Calif., Capt. Walter Smit, from Fort Riley, Kans., and 1st Lt. Don L. Deane, from Fort Bliss, Tex., to Army Medical Center, Washington, D. C., Sept. 15; Capt. Benj. F. Leach, from Carlisle Barracks, Pa., to Army Medical Center, Washington, D. C., Sept. 15 (temporary duty, 4 months); Corporal Robert W. Pitman, from Carlisle Barracks, Pa., to Fort Jay, N. Y., and World's Fair detachment at Camp Geo. Washington, N. Y. (temporary).

Extension.—Capt. Curtis W. Betzold's tour of foreign service in the Philippine Department, extended one year.

Promotions.—To captain: 1st Lts. Stephen G. Asbill, May 14, 1939, and Benj. F. Leach, May 17, 1939.

KINSLEY has WESTERN TYPE
ENCEPHALOMYELITIS VACCINE
Chick Embryo Propagated

For the immunization of horses and mules against Western type Encephalomyelitis.
This product consists of a suspension of formalin killed chick embryo Encephalomyelitis virus.

DIRECTIONS: Inject two 10 cc doses hypodermically into healthy tissues under aseptic precautions, 7 to 10 days apart.

	Code
One Treatment (2-10 cc) package	Jack
Five Treatments (10-10 cc) package	Mare

Discounts: 10% trade—2% cash

Will appreciate your orders.

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CAL-DEXTRO SOLUTION
(FORT DODGE)

A distinctively different Calcium preparation intended for intramuscular and intravenous use

Now the universal preparation of its type with veterinarians everywhere

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1. Its calcium is in a highly ionizable form.
2. The full 500 Cc dose reduces relapses to a minimum.
3. Non-irritant by any channel of injection.
4. Distinctive red-brown color.
5. Stable, standardized, sterile.
6. Non-precipitating in any climate.

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Each 500 Cc rubber-stoppered bottle contains:

Calcium (elemental).....12.42 grams
(Equivalent to 141.22 grams Calcium Gluconate.)

Anhydrous C. P. Dextrose .....75.00 grams

Isotonic Base.....Q. S. 500 Cc

★

Code—

Sail: Box Six 500 Cc vials $4.50

2 Boxes (12 vials)..... 8.60

Also supplied in small 10 Cc vials far small animals at $2.00 for package of 12 vials. (Code: Soar)

FORT DODGE LABORATORIES, INC.
FORT DODGE, IOWA

Veterinary Colleges Graduate 485

The veterinary colleges of the United States and Canada this year conferred degrees on 485 senior students—the largest number graduated in any one year since 1920.

Twenty-four students received their degrees at the 67th annual commencement exercises of the Alabama Polytechnic Institute, held May 28.

Colorado State College graduated 26 from the veterinary division. Of these, three, Harold Deane, Eugene George and H. Verne Wiser were elected to Phi Kappa Phi, the scholastic fraternity, and Wiser received the award for the highest scholarship in the entire institution.

Iowa State College conferred degrees on 48 students at its commencement exercises June 12. Clarence Dee was the honor student in veterinary medicine, winning the George Judisch Award, and Margaret W. Sloss was graduated with high honors. Prizes for work in clinical practice were won by Andrew L. McGrath, first, and Willis A. Liebsch, second.

The largest number of graduates from one school, 68, received degrees from Kansas State College, at the 76th annual commencement exercises on May 29. Wade O. Brinker and Norwood H. Casselberry were graduated with high honors, and Jack R. Knappenberger, Morris A. Nossov, Guy A. Railsback, and Edgar L. Taylor with honors.

Michigan State College graduated 30 veterinary students at its 81st annual commencement. The senior prize offered by the Michigan State Veterinary Medical Association was awarded to Elmer L. Matthews.

Thirteen graduates of the veterinary school of the University of Montreal received degrees at the commencement exercises May 6. Lucien Brault was graduated with high honors, and Daurent Choquette, Urbain Dinel, Napoleon Mignault and Lucien Gonneville with honors.

Ohio State University conferred 48 veterinary degrees at its 62nd annual commencement exercises June 12.

The Ontario Veterinary College at the University of Toronto was a close second to Kansas State College in the number of graduates, conferring degrees on 61 students, at the convocation held May 12. The gold medal for the highest aggregate standing was awarded to E. L. Symington, and second, third, and fourth prizes to J. H. Leslie, N. A. Labzoffsky, and Miss J. M. Rumney, respectively.

Thirty-nine students received degrees from the New York State Veterinary College at Cornell University at the 71st annual commencement exercises June 19.

At the 183rd annual commencement of the University of Pennsylvania, 52 veterinary degrees were conferred. Alvin F. Sellers won the J. B. Lippincott Prize of $100 for the highest general average in examinations during the four years, and the Leonard Pearson Prize, for the member of the senior class who in the judgment of the faculty of the School of Veterinary Medicine is best qualified, was awarded to Howard L. Baker, Jr. Other prize winners were Leonard J. Abell, Samuel H. Moser, Bertrand B. Dionne, and Glenn D. Gates.

The Agricultural and Mechanical College of Texas conferred 46 veterinary degrees at its 63rd annual commencement exercises June 2.

Thirty veterinary students received degrees from the State College of Washington at its 43rd annual commencement exercises June 5. Birdsall N. Carle and Leslie C. Murphy were graduated with highest honors, and Philip A. Lee, Jr., with high honors.

Iowa State College Press Established

A new publication outlet for manuscripts dealing with science and technology has been provided at Iowa State College, Ames, Ia., by the recent organization of the Iowa State College Press. The new press will consider for publication manuscripts from any source. It will be especially interested in developing publications in certain fields in science and technology for which satisfactory publication channels are not elsewhere available. The manufacture and sale of Iowa State College Press publications will be conducted by the Collegiate Press, Inc., also of Ames, which entered the publishing field in 1934.

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A New and Easy Method of Detecting Canine Diabetes

The Denver Chemical Mfg. Co. have succeeded in developing in their laboratories a new, dry, micro-reagent for making instantaneous tests for sugar in urine, entirely practical as a means of making regular tests for glycosuria in canine patients.

Galatest consists of a compound in powder form. Its use is simple and easy. A small quantity of the powder is deposited on some dry surface and, with a medicine dropper, one small drop of urine is allowed to fall onto the powder. The reaction is instantaneous. If sugar is present it will reveal itself in degrees varying from 0.1% to 1.00% and over. It is quick, accurate and inexpensive.

Veterinarians will find considerable scope for it in their canine practice for detecting unsuspected cases of diabetes and for use as a better control measure for such as may have the disease in its incipiency. Full particulars may be had by writing the Denver Chemical Mfg. Co., 163 Varick St., New York.

KINSLEY has **WESTERN TYPE ENCEPHALOMYELITIS VACCINE**

Chick Embryo Propagated

For the immunization of horses and mules against Western type Encephalomyelitis.
This product consists of a suspension of formalin killed chick embryo Encephalomyelitis virus.

DIRECTIONS: Inject two 10 cc doses hypodermically into healthy tissues under aseptic precautions, 7 to 10 days apart.

	Code
One Treatment (2-10 cc) package	Jack
Five Treatments (10-10 cc) package	Mare

Discounts: 10% trade—2% cash

Will appreciate your orders.

KINSLEY LABORATORIES
KANSAS CITY • MISSOURI

Veterinarian Organizes a Superior Troop

The Lancers, an organization of the 122 Field Artillery, Illinois National Guard, put on a show at the regimental armory April 15, 1939, that was universally acclaimed the best in its history. Concerning the show *Alfalfa*, a regimental publication, said:

"The troop reached a peak of perfection seldom attained by any mounted group operating without command. They excelled themselves.

"Too much cannot be said of Capt. Hubert H. Harz, V.C., under whose guidance this most worthy organization was formed and under whose leadership it has reached its present peak of excellence in five years.

"The building up of a troop such as the Lancers, the constant hard work on the part of the men, their punctuality in getting down to drill two nights a week and their obedience to command, week in and week out, throughout the year, calls attention to the power of a sparkling personality. The vibrant qualities of their leader is reflected by every trooper—because he considers his skipper the tops.

"In a short talk after the show, Capt. Harz broke a precedent by confessing to the men, after five long years, that he was proud of them."

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Easy to apply. Saturate on with hand—no rubbing. Doesn't burn, set skin "on fire," kill hair, or scar. Head let down in few hours. No rest necessary in many cases. Vary application to produce just degree of counter-irritation needed. Diluted with oil, makes any strength liniment desired. FREE SAMPLE—a $1.00 bottle sent free postpaid upon request if you have never had one . . . . treats several cases. It doesn't pay to be without this convenient, effective and economical preparation; write for sample or mail order today. 4-oz. size, $1.00; 16-oz., $3.00.

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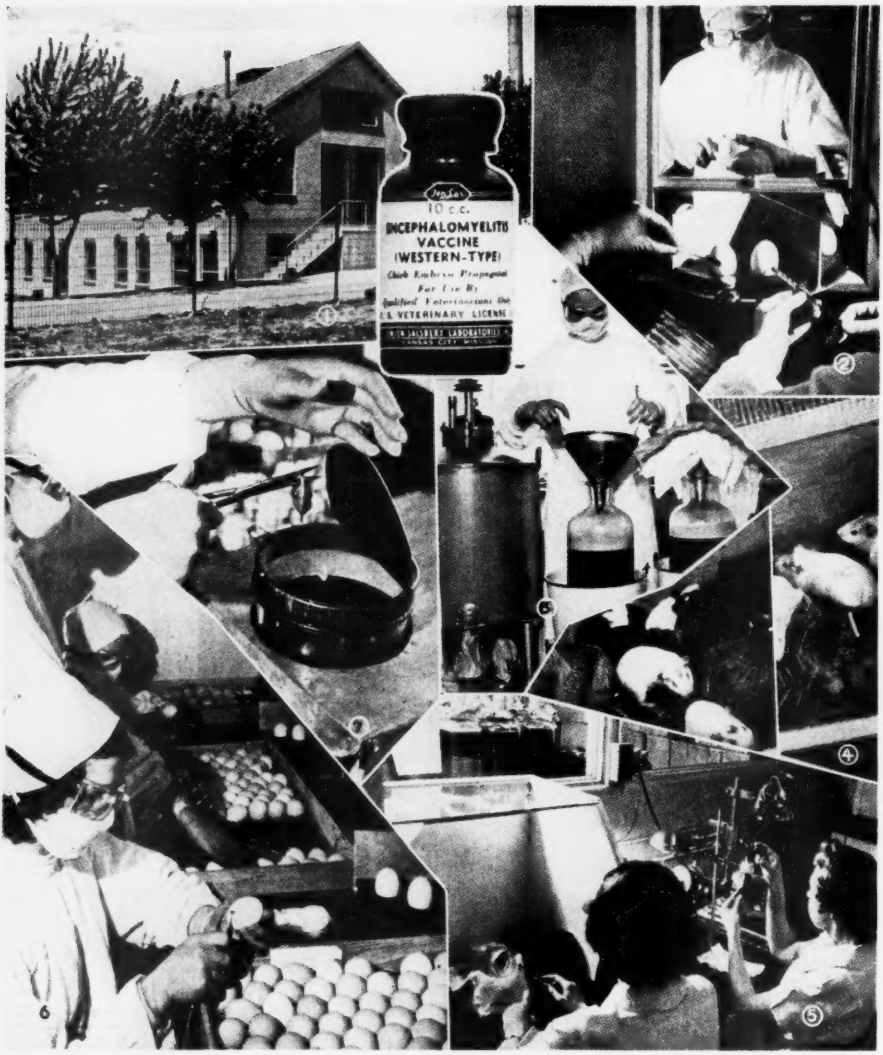

Sequence in production of Jen-Sal Equine Encephalomyelitis Vaccine (Chick)

(1) Newly constructed laboratory building exclusively devoted to production of Encephalomyelitis Vaccine (Chick).

(2) Inoculating eggs. A small opening is drilled in the egg which is then placed on the turnstile conveyor which carries it to an adjoining room where the virus is inoculated into the embryonic tissue. Opening is then sealed with wax.

(3) Grinding, filtering, cooling, diluting, collodizing and formalizing are preparation processes of prime importance. Note type of protecting appliances and clothing worn by the operator.

(4) Guinea pigs have a controlling role as these test animals give evidence of vaccine potency, virus concentration, etc. Note spots on cranium indicating location of subdural virus inoculation of test pigs.

(5) Filling the tested and approved product in final containers.

(6) Drilling eggs for virus inoculation and arranging trays for subsequent incubation.

(7) The embryo suspended between the scissors blades has just been aseptically removed from the incubated egg and is about to be deposited in the jar for final processing.

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Anti-Erysipelas Serum (Swine)

(FORT DODGE)

Produced under the same high standards that have made the Fort Dodge trademark a symbol of reliability among American veterinarians . . . .

250 Cc
ANTI-ERYSIPELAS SERUM (SWINE)
For the prevention and treatment of swine erysipelas.
Prepared under U. S. Vet. License No. 112
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FORT DODGE, IOWA
Code Word STAGGER

● Anti-Erysipelas Serum—Swine (Fort Dodge) represents the sterile, filtered blood serum of select horses hyperimmunized against picked strains of *E. rhusiopathiae*. Its exceptional potency insures quick, efficient results both as a prophylactic and curative. Every lot is tested on pigeons and must protect against a lethal dose of *E. rhusiopathiae* of standard virulence. Full stocks available at all Fort Dodge branches and agencies.

Again Available
At Reduced Price Levels

Code—

Inflame: Vial 50 Cc.....$0.80
Two vials (100 Cc)..... 1.50
Stagger: Vial 250 Cc..... 3.00
(Less usual discounts)

Fort Dodge Laboratories, Inc., Fort Dodge, Iowa

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Army Veterinary Service

Transfers.—Lt. Col. Harold E. Egan, from Fort Francis E. Warren, Wyo., to Seventh Corps Area, Omaha, Nebr., and additional duty as attending veterinarian at Fort Omaha and Fort Crook, Nebr., Sept. 1; Lt. Col. Gerald W. Fitz Gerald, from foreign service to San Antonio General Depot, San Antonio, Tex., and additional duty as attending veterinarian at Randolph Field, Tex.; Lt. Col. Jesse D. Derrick, from Seventh Corps Area, Omaha, Nebr., and additional duty at Fort Omaha and Fort Crook, Nebr., to Hawaiian Department, Sept. 9; Lt. Col. Oscar C. Schwalm, from Fort Bliss, Tex., to Fort Des Moines, Ia., Aug. 24; Maj. Jack G. Fuller, from Fort Snelling, Minn., to Carlisle Barracks, Pa., Sept. 1.

Amendment of Orders.—Orders assigning Lt. Col. Edward M. Curley to Fort MacArthur have been amended so as to assign him to Los Angeles, Calif., and additional duty as attending veterinarian at Fort MacArthur, Calif., and Fort Rosecrans, Calif.

Meat and Milk Inspection.—Authority has been granted for the calling to extended active duty of 192 veterinary reserve officers in connection with the Air Corps expansion program; about one-quarter immediately and the remainder in January, 1940. These officers will be assigned to duty at the larger air fields for the inspection of meat, meat-food and dairy products.

The following veterinary officers have been designated to make inspections of meat, meat-food and dairy products, at the points indicated, for supply to the various units engaged in the First Army maneuvers: Lt. Col. Irby R. Pollard, Fort Worth, Tex.; Lt. Col. Will C. Griffin, Chicago, Ill.; Lt. Col. Nott Ramsey, East St. Louis, Ill.; Maj. Stanley M. Nevin, Lake Charles, La. Capt. Arvo T. Thompson, on duty at the Army Veterinary School, Army Medical Center, Washington, D. C., has been detailed to make inspections at the following places in order: Beatrice, Nebr.; Columbus, Nebr.; Atlantic, Ia.; Clay Center, Kans.; Salina, Kans.; St. Joseph, Mo.; and Kansas City, Mo.

Promotions.—To captain: 1st Lts. Robert J. Brown, July 15; and Earl G. Kingdon, July 20.

Veterinary Corps Reserve

New Acceptances.—1st Lts. John Eldon Abbott, Francis Whipple Andrews, Ernest D. Barrows, Israel Berkowitz, Benjamin Donald Blood, Wade Oberlin Brinker, Anthony Michael Burdo, Nathan Walter Burg, Franklin Harold Burr, Walter Earnest Cameron, Norwood Harry Casselberry, Forrest William Clark, Alton Monroe Coddington, Wayne Devere Collins, Harry Jacob Conrad, John Robert Cocoran, Philip Henry Curry, Harold Myers Deane, Peter DeCinque, Clifford Newton Decker, John Patton Denton, William Hyde Dietrich, James Andrew Eskeldson, David Edward Evans, Murray Feldman, Vurl Eldon Fisher, Eugene Wesley George, Peter Joseph Germanio, Harry Arthur Gorman, Glenn Gordon Gross, Thomas Joseph Guilfoil, Clare C. Hamilton, Harris Warren Hantman, Albert Leo Havlik, Merle Logan Henrikson, Arthur Conrad Herzberger, Virgil John Humphreys, Donald Clayton Innes, Charles Earl Irvin, Jr., Lloyd Edward Jameson, Herman August Jokerst, Raymond Albert Jones, Frank Wilson Jordon, Wendell Lee Kanawyer, Jack Ross Knappenberger, Robert Jerome Lee, Henry Loughridge, George James MacLean, Albert Leon Malle, Joseph Raymond Massey, Jr., Leonard John Miller, Lynus Robert Morton, Donald Fleet Mossman, Samuel Siskind Nebb, Walbert Oscar Nelson, Morris Aaron Nossov, John Herbert Pastor, Walter Bruce Prendergast, Bert Reinow, Nathan Allen Turner, Herbert Edward Viergutz, Ralph Charles Vierheller, Horace Verne Wiser, Major Norman James Pyle, 1st Lts. Leonard J. Abell, Dale S. Adams, Marion C. Alson, John P. Ayres, Lucien P. Bailey, Ralph D. Barner, Clinton D. Barrett, Geo. D. Batchelder, John W. Beauchamp, Clarence K. Bennett, Clarence F. Bent, Joseph H. Berger, Frank McK. Birch, Sidney S. Bjornson, Ernest W. Bloomquist, Howard J. Bly, Vincent L. Boldt, Herbert P. Bolks, Warren E. Bowstead, Marcus E. Boyer, Paul E. Boyer, Lemuel A. Branch, Willard C. Brooks, George P. Broussard, Clark E. Burt, Lee R. Chapman, Arthur B. Christian, Paul Christian, Robert L. Clinton, Wesley A. Clem Jr., James Clements, George C. Coburn, Clarence C. Combs Jr., Harold Y. Cooper, Willard E. Corry, J. B. Couch, Mark R. Crandall, Eugene F. Damer, William D. Daugherty, Clarence E. Dee, Vincent Y. Druley, Fernley W. Duey, William M. Dungan Jr., Oren G. Eastep, Clifford G. Enge, Percy Enge, Milton R. Evans, Gerald A. Faatz, Raymond Fagan, Walter J. Fallon, Robert Ferber, Elkana M. Finney, Ralph C. Fish Jr., Charles W. Fox, Morse Andrew Gates, Benjamin F. Gearhart Jr., James H. Gillespie, Sherman A. Glass, Russell W. Gold, Lester J. Gorman, Douglas H. Gregory, Glen Grisby Hampton Jr., Earl M. Harris, William K. Harris, William A. Haines Jr., Ronald T. Hauge, Oliver P. Heller, Benjamin S. Hensen, James T. Herron, William F. Hoffman, John M. Holmes, James M. Hood, Roy I. Hostetler, Raymond R. Houser, Reuben B. Hovland, Welling C. Howell, Lyman L. Hoy, Aubrey M. Hutton, William E. Irwin, Harold D. James, Oliver L. Jenkins, Leon M. Jones, Russell C. Jones Jr., Robert P. Juni, Elbert L. Kelley, Joseph Boston Key, Leonard Krewitz, Charles D. Labahn, Norbert A. Lasher, Philip A. Lee, George A. Leanord,

Hugh M. Lightbody, Stanley A. Lovik, Charles T. Luker, John N. McCamish, Ray McFarland, Robert J. McFarland, James J. McCarthy Jr., Kenneth J. McKenzie, Ernest Mack, Jerry T. Martin, Samuel Melworth, Clayton H. Mickelson, Harold K. Miller, Harold B. Mills, Fred L. Molt, Matthew B. Munson, Karl H. Muntz, Leslie C. Murphy, Clifford L. Nelson, Wm. E. Niemeyer, Dean L. Niffenegger, Florian W. Nold, Joseph S. Palen, Herschel H. Payne, Albert P. Pentick, Curtis A. Poppenhouse, Gerhard C. Poppenhouse, Ralph Pover, Walter D. Primerano, Sigmund T. Reich, James D. Ramsey, Glen S. Remsberg, Glenn W. Rieke, Ernest W. Rivers, Harry J. Robertson, Donald E. Rodabaugh, Martin A. Ross, Bernard B. Rovner, Rowland W. Rushmore, Sander A. Sacks, Daniel P. Sasmere, Carl H. Scholle, Alpheus H. Seeley, Alvin F. Sellers, Carl M. Sepponen, Henry P. Shoeman, LaMont H. Shultzman, Roland E. Sivyer, Daniel Skelton, Warren H. Smeltzer Jr., Earl Smith, Sydney M. Smith, Gail B. Smith, Emmett W. Spieth, John W. Spranklin Jr., Earl M. Sprunger, Darrell S. Steele, Karl F. Steinbach, William E. Steinmetz, Seidel M. Stephens, William F. Stoudenmire, Willard M. Strawn, Edward W. Swarthout, Richard C. Schofield, George G. Rannebaum, Edgar L. Taylor, Willard B. Teller, Geo. O. Thomas Jr., Victor Tierstein, Roland E. Vollmar, Ralph H. Wadsworth,

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George Walmsley, Drue S. Ward, Paul M. Washburn, Floyd B. Watts, Lonnie H. Weaver, Ralph S. Weston, Robert H. Yager, Edward B. Zickefoose.

Promotions.—To Major: Joseph H. Kitzhofer. To Captain: Glen O. Fly, Vaughn E. Ishee, Geo. M. Kerr, Leo L. Lieberman, Andrew J. McCreary, Lloyd J. Michael. To 1st Lieutenant: Ferdinand O. Johanson, Albert K. Tice.

New Assignments to Active Duty with CCC.—Capts. Fay E. Broad and Richard E. Geisler.

Termination of Assignment to Active Duty with CCC.—Capt. Rudolph H. Omdalen; 1st Lts. Ray S. Attaway, Absolom B. Rich and George A. Morrison.

New Policy for CCC Medical Services

Effective July 1, 1939, a new policy was adopted in connection with medical, veterinary and dental services rendered for the CCC. As the periods for which they were called to active duty expire, reserve officers of the Medical Department will be replaced by physicians, veterinarians and dentists in a civilian status. Under this plan all duty performed by Medical Department reserve officers on active duty for the CCC will be done by members of the three professions indicated on a civilian basis.

It is anticipated that a relatively large number of these reserve officers will accept civilian appointments.

ENCEPHALOMYELITIS

This malady can be controlled by the proper use of chick embryo vaccine. However, Encephalomyelitis may become widespread in various communities this season because a relatively few horses and mules have been vaccinated.

Practitioners should be on the lookout in their respective communities for the occurrence of actual cases of the disease so that an extensive outbreak can be promptly averted.

For your convenience— **The Kinsley Laboratories**

HAVE

ENCEPHALOMYELITIS Vaccine

Code (Western type)

Jack—One treatment (2-10 cc) package.....$1.50
Mare—Five " (10-10 cc) " 6.00

Discounts: 10% and 2% ***Will appreciate your orders.***

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SPECIAL

DAIRMOL DUSTING POWDER
FOR GRANULAR VAGINITIS

Antiseptic **Astringent**

"THE DAIRMOL WAY"

Careful study indicates the best method of application to be that of spraying the dry powder evenly over the walls of the vagina by means of a Powder Blower designed according to our specifications. Over 400 outfits in use among prominent veterinarians.

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Armstrong Resigns from Chappel Bros., Inc.

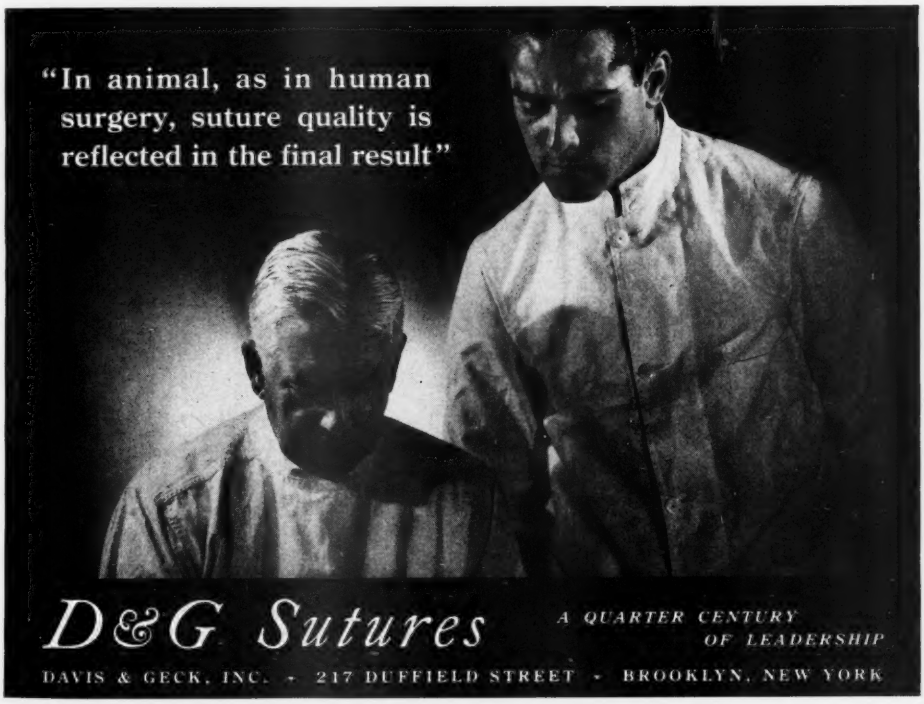
Walter E. Armstrong, Secretary and General Sales Manager of Chappel Bros., Inc., Rockford, Illinois, resigned from that company July 8. By resigning his post, he terminated an 11-year association with the makers of Ken-L-Ration dog foods. Mr. Armstrong, who has long been interested in breeding fox terriers, said he will continue his breeding activities. He made no further announcement of his plans.

Dr. Veterinarian:

The only way for you to know conclusively the proved high nutritional value of Security Dog Food is to accept our liberal professional samples and try Security.

●Permit us to furnish you (without charge) this professional sample. Security is specifically designed to provide a feeding regimen that is complete, adequate and flexible . . . to furnish different ages and breeds of dogs with every vitamin, nutrient and scientific development that nutritional science recommends. Every veterinarian should take advantage of this opportunity. Write now for your sample. Security Mills, 44 C St., Knoxville, Tennessee.

Makers of Meal, Pellets, Cubes; Kiblets, Kibbles, Whole Biscuit; Meatmix for mixing with Security Dog Food; and Nutrolak, the simulated bitch's milk.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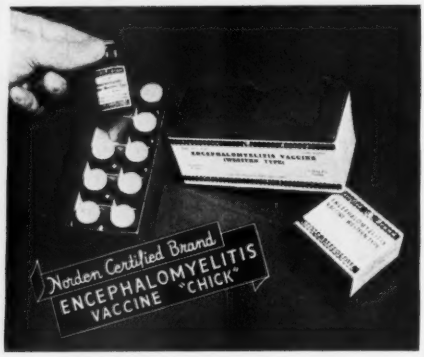

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Has withstood severest tests as outlined by and acceptable to the U.S. B.A.I.

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(Western Type)

CHICK EMBRYO PROPAGATED

Code D U O—two 10 cc vials. $1.10
Code V DUO—ten 10 cc vials.. 5.00

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LINCOLN The Mark of Quality NEBRASKA

Inscribes Veterinary History to Public Library

"The Houston Veterinary Association presents these two volumes of 'VETERINARY MILITARY HISTORY' to the Houston Public Library as an evidence of the high esteem in which we hold the institution; as a patriotic gesture; and that seekers of authentic historical data and knowledge, and the reading public, may become acquainted with a phase of Veterinary Medicine which otherwise would not be available to them." [signed by 25 members of the Association]

The foregoing is the inscription in copies of "Veterinary Military History" presented to the public library of their city by the Houston Veterinary Association.

Dr. R. Payne McComb's fox terrier entries from his Ten Oaks kennels in Santa Barbara, Calif., broke a California dog show record for fox terriers shown by one owner at the Santa Barbara Kennel club show July 9th. Doctor McComb had 16 fox terriers of his own in the show and there were five other McComb terriers exhibited by other owners. McComb's Top Row of Wildoaks went best fox terrier in the show and was second in the class of all terriers. Twelve other McComb dogs were included among the winners.

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Horse Back To Work in Three To Five Days

It is a powerful antidote to inflammation occurring in the periosteum, articulations, bursæ, tendons, ligaments; also where there is pain, exostosis or lameness. Usually only one application is necessary. One bottle is sufficient to treat three or more cases.

Endorsed by almost every veterinarian that has given it a trial.

FREE Booklet—"Reminders in Diagnosing Obscure Lameness."

Price per bottle..$2.00
Three bottles 5.00

Free Sample. **To Every Veterinarian that has not received a sample, we will gladly send postpaid a liberal sample upon request. No obligation.**

DETROIT VETERINARY SUPPLY CO.
Detroit, Michigan
Canadian Branch, Windsor, Ontario

Extensive Veterinary Publicity

Seasonal live-stock diseases of hot weather months are being featured in a series of special news releases to newspapers and radio stations this summer by the Associated Serum Producers, through their educational bureau, The American Foundation for Animal Health.

The releases are designed to call attention to these diseases, and to urge upon the farmer the importance of calling his veterinarian for reliable diagnosis and treatment in the event that suspicious symptoms become evident.

Among the subjects being covered are hog cholera, encephalomyelitis, malignant edema, lockjaw, milk fever, pink eye, erysipelas, weed poisoning, fowl cholera, big head in sheep, hog mange, enteritis, heat stroke in hogs, screw worms, listerellosis, blackleg, mastitis, range paralysis, and many others.

Over 1,200 newspapers and 116 radio stations now receive this material regularly from the American Foundation for Animal Health.

Prof. Charles Sumner Plumb, 78, Columbus, O., professor emeritus of the animal husbandry department of Ohio State university, and one of the world's leading authorities on sheep, died March 4 of a heart ailment.

★ Oster ★

SMALL ANIMAL CLIPPER

The All-Year All-Purpose Clipper

ONLY $19.50

General Clipping ● Plucking Length Clipping ● Surgical Shaving ● all are performed safely and quickly with the OSTER—the clipper with the Detachable Cutter Head.
The Instrument Size ● The Great Power ● provide a new ease and sureness when clipping.
The Smoother and Quieter Performance ease animal tension and dispel clipper fear.

JOHN OSTER MANUFACTURING COMPANY
Racine, Wisconsin, U. S. A.

Vitality DOG FOODS
HAVE INCREASED 50%
IN POPULARITY THIS YEAR

The rapid increase in users of VITALITY DOG FOODS year after year has followed right on the heels of the Sixty Day Vitality Feeding Trial. Dog owners feed VITALITY for 60 Days, like it so well they continue to feed it, tell their friends to try it and the number of satisfied feeders keeps growing constantly.

Much of the satisfaction obtained by VITALITY feeders is due to an original dog feeding plan.

VITALITY ORIGINATED A DOG FEEDING PLAN

VITALITY'S original plan of dog feeding consists of a special feed for breeders, a separate feed for workers and maintenance, and a base ration for feed mixing. Try this plan on our Guarantee of Absolute Satisfaction.

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WORRYING ABOUT FOOD

Here at last, is a practical plan for veterinarians to eliminate food as a cause of dog ailments. Enlist the aid of TI-O-GA'S Experimental Kennels with over a hundred dogs and a rat laboratory. A new, free Controls Service you'll find most valuable is at your disposal. Write at once for 20 page explanatory booklet—*"How TI-O-GA Dogs help your Dogs."* Full of practical suggestions. *It's FREE.*

BALORATIONS, Inc.
Div. of Tioga Mills,
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TI·O·GA
complete
DOG *and* PUPPY FOODS

Deaths of Veterinarians

Joseph L. Wilder, 63, Akron, N. Y., COR '01, Mar. 2; George A. Dunbar, 55, Oakland, Calif., Apr. 5; Thomas Blythe Houschild, 49, Kennewick, Wash., Apr. 16; Alfred L. Murch, 76, Bangor, Me., HAR, Apr. 21; A. D. Knowles, West Palm Beach, Fla., KC '06, Apr. 24; Henry J. McCarthy, 71, Baltimore, Md., GW '11, veterinarian for the Maryland State Racing Commission until his retirement in 1937, Apr. 25; Frank V. Matthews, 68, McKeesport, Pa., May 4; George M. Thorndike, 68, Alto, Mich., GR '13, May 6; Frederick M. Perry, 73, Framingham, Mass., World War veteran, May 9; Ford Bacon, 57, Huntington Mills, Pa., May 10; A. S. Makin, Hope Hull, Ala., May 14; John N. Rosenberger, 52, Philadelphia, Pa., UP '10, May 17; Frank H. Mackie, 74, North East, Md., UP '89, World War veteran, May 18; John James Griffith, 56, Bradford, Pa., UP '10, May 20; S. J. Carter, Jacksonville, Ill., ONT '19, May 21; Daniel Hisey, 77, Saginaw, Mich., ONT '94, May 25; Walter R. Van Ness, 53, Mason, O., ONT '07, B. A. I. 1914-1939, June 3; David L. Bolger, Cambridge, Mass., MG '92, June 7; A. A. Kritt, 42, Albany, Ga., OSU '20, B. A. I., June 7; Robert G. Bose, Troy, N. Y., NYU '91, June 22.

Repeat Sales Tell the Story of FISTONE'S SUCCESS

● Thousands of veterinarians in U. S., Canada and England have used Fistone successfully. They have tried it, found, to their satisfaction that it does everything we claim for it, therein lies the story of this wonderful scientific medicine's success.

Fistone has proved successful in 85% of such cases as Fistula of the withers, poll evil, chronic nasal catarrh, quittor, endo-metritis, and all other chronic suppurative disorders.

Fistone supplants difficult surgery and objectionable after-care. There is no need for mussy, tedious continual syringing.

Fistone is a powder, given in bran and oats, morning and evening, and its purpose is to destroy chronic local or focal infections.

The coupon below is for your convenience in ordering, mail it now for a trial order.

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College Corner, Ohio

Enclosed please find check for $8.00, for which send me one dozen 12-ounce boxes of FISTONE (Trial Order) once only. (Regular price $10.) One-half dozen boxes $5.00.

Dr.....

Address.....

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Easy to apply. Saturate on with hand—no rubbing. Doesn't burn, set skin "on fire," kill hair, or scar. Head let down in few hours. No rest necessary in many cases. Vary application to produce just degree of counter-irritation needed. Diluted with oil, makes any strength liniment desired. FREE SAMPLE—a $1.00 bottle sent free postpaid upon request if you have never had one. . . . treats several cases. It doesn't pay to be without this convenient, effective and economical preparation; write for sample or mail order today. 4-oz. size, $1.00; 16-oz., $3.00.

Detroit Veterinary Supply Co.
460 West Jefferson Avenue, Detroit, Michigan
Canadian Branch, 139 Sandwich St., Windsor, Ontario

Army Veterinary Service

Assignments.—Lt. Col. Peter T. Carpenter, to additional duty as assistant to the officer in charge, Southwestern Remount Area, Colorado Springs, Colo., in connection with inspection and purchase of public animals and operation of the Army horse breeding plan; Capt. James B. Nichols, Fort Mason, Calif., as transport veterinarian on the USAT Meigs for the trip scheduled to sail from San Francisco about Oct. 5, 1939, to the Philippine Department and return.

Transfers.—Lt. Col. George J. Rife, from Fort Leavenworth, Kans., to North Central Remount Area, Kansas City, Mo., Sept. 30; Capt. Charles S. Greer, from Fort Riley, Kans., to Fort Leavenworth, Kans.; Capt. Lloyd C. Tekse, from Presidio of San Francisco, Calif., to Presidio of Monterey, Calif., Oct. 25.

Resignation.—Capt. Robert J. Brown, Aug. 24, 1939.

Veterinary Corps Reserve

New Acceptances.—1st Lts. Leonard Mirsky and Abe L. Stewart.

Promotions.—To Captain: Nels Frank Christensen, Oscar Frederick Fischer, Jr., Samuel Kelsall III.

Separation.—Major George Bernard Hartke, Philadelphia, Pa.; died Feb. 15, 1939.

AT THE NEW YORK WORLD'S FAIR—

DAIRMOL **(deodorant & antiseptic) and** ***TRUSOL*** **(new mown hay type) Floor Disinfectant are the**

Choice of the Walker-Gordon Exhibit in the protection of both public and dairy herd. Free Folder on Request.

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MORE THAN 85%

of the Veterinarians who received our sample of SANAHIDE have ordered one to five gallons for their use in treating Eczema, Sarcoptic Mange, and Ear Mites.

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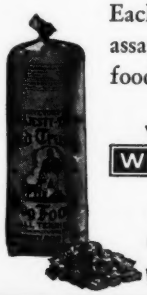
AS evidence of our desire to make Ideal Dog Food everything its name implies, we have recently renewed our Fellowship in one of the nation's leading Universities *for the fourth successive year.*

Each day's production of Ideal Dog Food is carefully assayed. What Science can add to a safe, sensible food for modern dogs, Ideal Dog Food will contain.



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U. S. Yards

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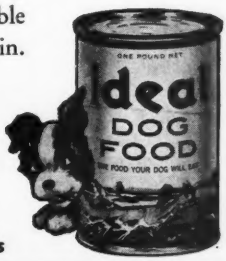
A SENSIBLE DOG FOOD



Wilson & Co. are distributors of Old Trusty Dry Dog Foods

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CARTER-LUFF CHEMICAL CO., HUDSON, N.Y.

PRICES

SINGLE BOTTLE $ 2.00
¼ DOZEN
1 BOTTLE FREE 5.00
½ DOZEN
2 BOTTLES FREE 8.00
1 DOZEN
4 BOTTLES FREE 15.00
2 DOZEN
4 BOTTLES FREE 25.00

AGENTS SOUTHERN STATES
Kentucky Serum Co.
LOUISVILLE, KY.

FOR PRICES IN CANADA WRITE TO
Wingate Chemical Co.
MONTREAL

Robert G. Bose, Troy, N. Y., died June 22 following an emergency operation for appendicitis. Doctor Bose, who was graduated from the New York State Veterinary College, New York University, in 1891, operated a small animal hospital in Troy for many years. He was city veterinarian of Troy until that office was abolished when the fire department was motorized. At the time of his death he was treasurer of the Nassau Matinee Driving Club, an association of harness racing enthusiasts. He is survived by a sister.

Dr. A. A. Hermann (CSC '10), Denver, Colo., won two cash prizes for himself and Henry Hoffman, manager of the Hermosa Hospital, Denver, August 20th when he wrote one of four best letters of thousands in the weekly "Letters Home" contest at the exhibit of the Westinghouse Electric and Manufacturing Company at the New York World's Fair. Doctor Hermann was visiting the Fair before attending the Memphis meeting of the A. V. M. A. The prize was awarded by Ray Perkins, radio star, on a coast-to-coast broadcast over the NBC Blue network.

POLL EVIL • FISTULA OF THE WITHERS

IF dressings of Antiphlogistine be applied both preceding and following drainage of an abscess, the most satisfactory results will usually follow. Antiphlogistine protects the parts, reduces the inflammation and swelling and aids in the healing process.

Where the abscess is still suppurating, the dressing is best applied with a control aperture for drainage.

Sample on request

ANTIPHLOGISTINE

THE DENVER CHEMICAL MFG. CO., 163 Varick St., New York

Dr. William H. Dodge, inspector of animals, milk and slaughtering at Leominster, Mass., for the past 42 years, retired from that position July 1st. Doctor Dodge, 74, was one of the city's oldest officials in years of service.

Paul Moser, noted breeder of prize-winning cocker spaniels, will discuss this breed of dog on the Red Heart radio show over the NBC Red Network at 3:45 p. m. (E.S.T.), Sunday, October 29.

The Beresford Cat Club of America will hold its 30th championship cat show at the Skyline Athletic Club, 188 W. Randolph St., Chicago, December 2nd and 3rd. For information address Mrs. A. A. Gour, 6638 Kimbark Ave., Chicago, Ill.

Forty-seven veterinarians of the Tenth District Veterinary Medical Association held an all-day meeting and clinic September 28 at Centerville, Ind. Operations were performed on cattle, horses, swine, dogs and cats brought in by farmers. C. F. Clark, of the faculty of the Division of Veterinary Medicine, Michigan State College, spoke on sterility in cattle. A banquet in the evening was followed by discussion of the clinic material.

AT THE NEW YORK WORLD'S FAIR—

DAIRMOL **(deodorant & antiseptic) and** ***TRUSOL*** **(new mown hay type) Floor Disinfectant are the**

Choice of the Walker-Gordon Exhibit in the protection of both public and dairy herd. Free Folder on Request.

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MASON'S *Kennel Fences*

Used by Leading Dog Hospitals **$69.55 and up**

Mason's are Real Kennel Fences—Strong, Good Looking and sold under a Money Back Guarantee to hold the largest and strongest dogs. Used and approved by Small Animal Hospitals everywhere.

SEND FOR FREE CATALOG and Low Direct Factory Prices of all kinds of Kennel Fences, Dog Proof Gates, Steel Kennel Stalls and Doors.

MASON KENNEL FENCE CO., Box 77, Leesburg, Ohio

IMMUNIZATION OF DOGS AGAINST DISTEMPER

From the field reports of hundreds of veterinarians, it is evident that dogs can be protected against distemper by the use of Sero-Toxylin (Kinsley), provided:

1. The dogs are four months of age when treated.
Puppies less than four months of age should be given a second treatment.

2. The dogs are healthy.

3. Proper dosage of Sero-Toxylin is given.

4. Dogs are properly cared for after treatment.

For the convenience of our Eastern customers, the Standard Veterinary Products Company, 16 East 23rd St., New York, New York, are our distributors. We will appreciate your patronage through them.

For results, use Sero-Toxylin

KINSLEY LABORATORIES

PHONE LOGAN 4600

1103 East 47th Street **Kansas City, Missouri**

FREE FOLDER FOR VETERINARIANS . . outlining the treatment of various infections with

● Also Price List quoting veterinary hospital discount price

SULFANILAMIDE SQUIBB
(Para-Amino-Benzene-Sulfonamide)

E. R. SQUIBB & SONS *Veterinary and Animal Feeding Products Div* **745 FIFTH AVE., NEW YORK**

Classified Advertisements

For Sale, Wanted, etc., $2.00 for 25 words or less; additional words, 8 cents. 25 cents extra when replies are sent in care of VETERINARY MEDICINE.

JUDY'S DOG ENCYCLOPEDIA, all dog subjects, $5.00; terrier trimming chart, $1.00 (3 for $2.00); Dog World, all-breed monthly, $2.00 for one year, $3.00 for two years, $5.00 for five years. JUDY PUBLISHING COMPANY 3323 Michigan Blvd., Chicago, Ill.

WANTED: An experienced Sales Manager by an eastern veterinary supply house. Veterinarian preferred. Address No. 256, care of VETERINARY MEDICINE.

WANTED: To Buy general practice in Missouri or Illinois. No property. Write details and price. Address No. 261, care of VETERINARY MEDICINE.

WANTED: Veterinarian to take over small animal practice. Share basis. Give experience, references, age, graduation date, when available. Prefer interview. New Jersey Animal Hospital, Union, N. J.

WANTED: Veterinarian as assistant or take practice. Address No. 263, care of VETERINARY MEDICINE.

FOR RENT: Equipped small animal hospital with kennels accommodating 18 dogs. Shady, outside runs. Mixed practice. Address Mrs. R. C. Rutan, 45 South St., Goshen, N. Y.

REDUCE THE COST OF FEEDING DOGS in your hospital by using dented, unlabeled Silver King Dog Food. Protein content (75% edible beef meat products), 10%; animal fat, 2%; maximum fiber, 1%. Also contains fresh milk and eggs, whole cracked wheat, barley, fresh edible bone soup, edible steamed ground bone, and cooked vegetables. Biologically tested by the Steenbock Line Test. $2.60 per case of 48 one-pound cans, F. O. B. factory; $2.50 per case in five-case lots, F. O. B. factory. Silver King Canning Co., Inc., Kaw Station, Kansas City, Kans.

FOR STUBBORN ULCERS

we recommend

Therapogen Powder

Proved by many years experience to be the best specific for this condition

THEODORE MEYER EST.
213 S. 10th St.
PHILADELPHIA, PA.

THERAPOGEN LTD.
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Also distributed by Norden Laboratories, Lincoln, Nebr.

LATEST SHOW HORSE NEWS! **SUBSCRIBE TO THE NATIONAL HORSEMAN**
(Est. 1865)

Reports all horse shows—beautiful pictures—dependable advice. Mail this coupon today in envelope or paste on penny postcard.

THE NATIONAL HORSEMAN, Louisville, Ky.
Send me 12 editions your monthly illustrated horse magazine for only $3.00!
Name ..... Address .....

A cow belonging to Louis Kuhns, Mahomet, Ill., ate $56 while he was asleep in the pasture. Dr. A. L. Blair was called to retrieve the currency. The first rumenotomy was unproductive, but the second revealed the money.

The Midwest Small Animal Association will hold its annual meeting and clinic at Burlington, Iowa, Thursday, November 2nd, with headquarters at the Hotel Burlington. O. F. Reihart, Omaha, Nebr., will demonstrate blood transfusions and urinalysis. The clinic staff will include Doctor Reihart and Drs. Schrader, Boston, Mass., and Schlotthauer, Rochester, Minn.

A leaflet distributed by the Associated Serum Producers at their interesting exhibit at the Memphis meeting of the A. V. M. A. showed the wide coverage of their educational campaign among live stock owners. News articles released by the American Foundation for Animal Health have totaled more than 21,600,000 circulation through 1,200 newspapers; illustrated health hints for live stock, more than 13,500,000 circulation through 1,000 newspapers; farm paper articles and advertisements, more than 13,700,000 circulation through 15 leading farm publications; and radio talks on 116 radio stations have reached an estimated audience of 130,000,000.

THE VETERINARY RECORD

Founded 1888

A weekly journal for the Profession.

Published by the

NATIONAL VETERINARY MEDICAL ASSOCIATION

of Great Britain and Ireland

36 Gordon Square

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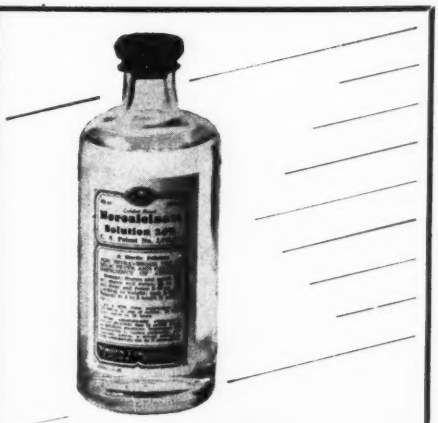

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NORCALCINATE

to the light!

Here's a calcium gluconate that's absolutely clear . . . not a floating speck or particle of precipitate to mar its efficiency. No wonder it's so easy and safe to administer.

It's ready for any calcium deficiency. NON-PRECIPITATING. No unusual precautions required for its protection!

Contains full dose of calcium gluconate. Specific for milk fever and calcium deficiencies.

In cases of six 350 cc and twelve 100 cc.

NON-PRECIPITATING EVEN AFTER FREEZING

NORCALCINATE WITH DEXTROSE in cases of six—500 cc and twelve 100 cc.

NORCALCIPHOS (calcium and phosphorus) for phosphorus deficiency in localities where relapses occur. In cases of six 300 cc.

Order by mail, phone, or wire.

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LINCOLN NEBRASKA

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AGENTS SOUTHERN STATES
Kentucky Serum Co.
LOUISVILLE, KY.

FOR PRICES IN CANADA WRITE TO
Wingate Chemical Co.
MONTREAL

Deaths of Veterinarians

Francis J. McCaffrey, New York, N. Y., formerly police department veterinarian, May 11; Immanuel Pfieffer, 59, GR, Bedford, Mass., May 24; Archie C. Gillis, ONT, Keene, N. H., June 8; Carl V. Reynolds, 62, Plymouth, Ind., June 9; F. O. Killian, 45, KSC '21, St. Louis, Mo., June 15; Teodulo T. Topacio, Manila, Philippine Islands, chief of the veterinary research division of the Philippine Bureau of Animal Industry, June 19; Fred D. Patterson, 43, ALA '21, Cuthbert, Ga., nine years on the staff at Alabama Polytechnic Institute and two years at Iowa State College, July 5; O. E. Strodtman, KC '11, July 14; Arthur Ester, KC '12, Monmouth, Ill., July 17; Glenn Thompsett, 53, COR, Delavan, N. Y., July 23; Joseph Whytock, 91, prior to his death the oldest living graduate of Toronto Veterinary College, Aug. 1; Oliver A. Taylor, MSC '15, Detroit, Mich., Aug. 16; C. D. Meredith, KC '04, Joplin, Mo., Aug. 23; George P. Frost, CHI, '97, Chicago, Ill., Sept. 11.

HARLTON'S LIQUID BLISTER *and* FREE BOOKLET

Easy to apply. Saturate on with hand—no rubbing. Doesn't burn, set skin "on fire," kill hair, or scar. Head let down in few hours. No rest necessary in many cases. Vary application to produce just degree of counter-irritation needed. Diluted with oil, makes any strength liniment desired. FREE SAMPLE—a $1.00 bottle sent free postpaid upon request if you have never had one . . . . treats several cases. It doesn't pay to be without this convenient, effective and economical preparation; write for sample or mail order today. 4-oz. size, $1.00; 16-oz., $3.00.

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SMALL ANIMAL CLIPPER

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General Clipping ● Plucking Length Clipping ● Surgical Shaving ● all are performed safely and quickly with the OSTER—the clipper with the Detachable Cutter Head.
The Instrument Size ● The Great Power ● provide a new ease and sureness when clipping.
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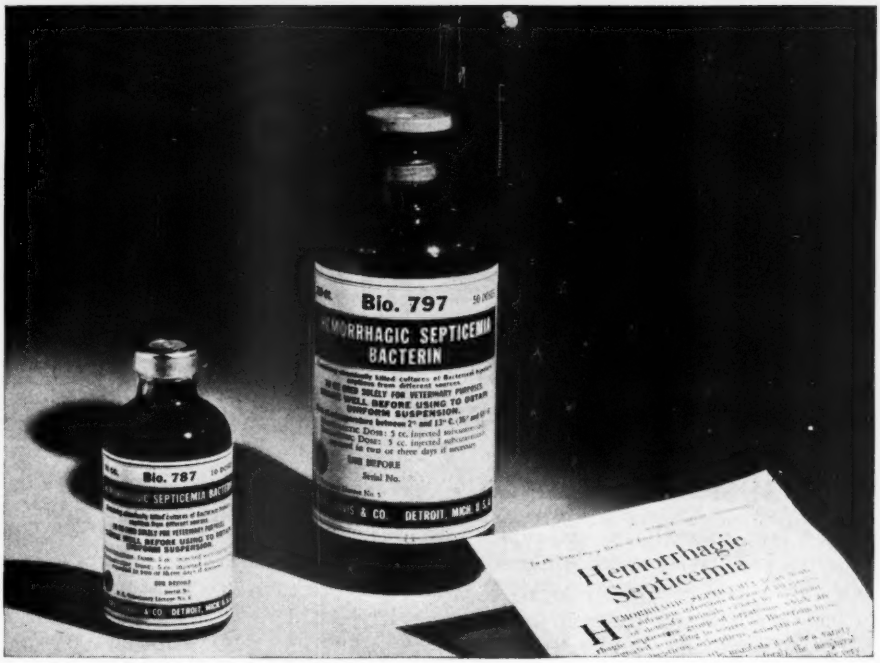

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Prepare now to immunize animals against hemorrhagic septicemia. Authorities agree that best results are obtained if animals are vaccinated at least ten days before they are shipped.

Hemorrhagic Septicemia Bacterin, P. D. & Co., is prepared from strains of organisms isolated from typical cases of hemorrhagic septicemia in domestic animals and buffalo. Intended for both prophylactic and curative use. Marketed in the following packages:

Bio. 780, 25-cc. bottle (5 doses). Bio. 787, 50-cc. bottle (10 doses).
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Write us for further particulars.

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The World's Largest Makers of Pharmaceutical and Biological Products

SUCH COMPANIONSHIP NEED NOT BE TERMINATED BY FATAL DISTEMPER INFECTION

CANINE DISTEMPER VACCINE AND VIRUS *Lederle*

ONE OR TWO DOSES of formalinized vaccine (killed virus), followed by the administration of living virus (desiccated), induces a complete and durable protection. This procedure has withstood the test of more than 10 years' time on all types of dogs. "Canine Distemper Vaccine *Lederle*" is a *perfected vaccine* containing a high concentration of killed virus, which is so correlated in potency with the activity of "Canine Distemper Virus (Desiccated) *Lederle*", that even occasional reactions are precluded.

ANTI-CANINE DISTEMPER SERUM *Lederle*

DERIVED FROM the blood of immune dogs which are repeatedly hyperimmunized with large doses of active virus.

—SHORT TERM PROTECTION: confers an immediate protection of approximately two weeks . . . in dogs during hospitalization . . . and during exposure at shows, field trials, in kennels, etc.

—THERAPEUSIS: when given early in the course of distemper, temperature is promptly reduced and infection is aborted.

PACKAGES:

CANINE DISTEMPER VACCINE *Lederle*
1 DOSE—5 CC. SYRINGE
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CANINE DISTEMPER VIRUS *Lederle*
(desiccated)
1-10 mg. DOSE WITH DILUENT IN SYRINGE

ANTI-CANINE DISTEMPER SERUM *Lederle*
VIALS OF 20 CC. AND 100 CC.

Sold only to Veterinarians

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BRUCELLA ABORTUS VACCINE

Lederle

[Formerly "Abortion Vaccine (Bovine) *Lederle*"]

CONTINUED experimental and field evidence, collected by both Governmental and commercial dairy interests, indicate that calfhood vaccination against Brucellosis is an effective, practical and economical control measure.

Calves vaccinated at four to eight months of age become highly resistant to future infection.

Disease-free, highly resistant herds may be built from calves vaccinated with a single injection of "Brucella Abortus Vaccine *Lederle*."

Lederle vaccine is prepared from culture No. 19 which is of low virulence and is supplied by the United States Bureau of Animal Industry.

PACKAGES:

"BRUCELLA ABORTUS VACCINE *Lederle*"

1 IMMUNIZATION—5 cc. VIAL

6 IMMUNIZATIONS—6-5 cc. VIALS

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ABORTION TEST ANTIGEN

Lederle

"Abortion Test Antigen *Lederle*" is a highly efficient diagnostic agent for the detection of Brucellosis of animals (Bang's Disease) and undulant fever in man.

The Antigen, as prepared by Lederle, is carefully standardized as to sensitivity and accuracy of interpretation on positive and negative sera.

Each serial number is submitted to the U. S. Bureau of Animal Industry for standardization check prior to distribution.

The use of "Abortion Test Antigen *Lederle*" in the rapid plate test renders a quick and reliable service to your clients. The test results may be secured within a few minutes and, where advisable, in the presence of your client.

Complete test equipment, plates and illuminating box with electrical connections available at minimum cost.

PACKAGES:

10 and 20 cc. dropper vials

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Can You Use a Cooked Meat For Dogs for 10c a Pound?

Now available—a canned food consisting of 85% solid meat, 5% bone and marrow and only 10% cereals—just about enough to hold the juices. Made from horse meat—nutritious—palatable—and selling at a retail price of 10c for a full pound can. That's what you get in the new

GAINES-MORE-MEAT

Almost every veterinarian who has seen this product has praised it. Indeed, it is oversold and not available in many places even yet. It looks like a product that will solve the fresh meat problem, and solve it economically. Your investigation is invited—and you, as a veterinarian, can buy it at wholesale prices.

Send today—a Post Card will do—for Free Can and Full Details.

GAINES FOOD CO.

Box H-6 SHERBURNE, NEW YORK

GAINES FOOD

Made to Restrain the Deficiency Diseases

The number of disorders caused by dietetic deficiencies seems to be definitely on the increase as science learns more about their origins. Naturally, a dog that is fed a complete food avoids these troubles. In no instance, or test, for many years, has Gaines Meat & Milk Meal been found inadequate.

Send for Free Professional Samples—and Full Details of Our Dealer Proposition—if your territory is "open"

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Formula 107-A

A Food for Orphan Puppies in Powdered Form

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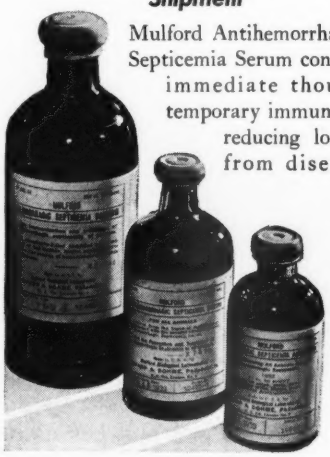

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This volume includes a description of all vascular plants in the United States that are known to cause poisoning in man or animals. Many drawings of the more important poisonous plants are included.

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This work is a complete summary and evaluation of all known facts about the *Mycobacterium tuberculosis avium* and the infections it causes—a reference tome that will not disappoint the searcher for any sort of information on the subject.

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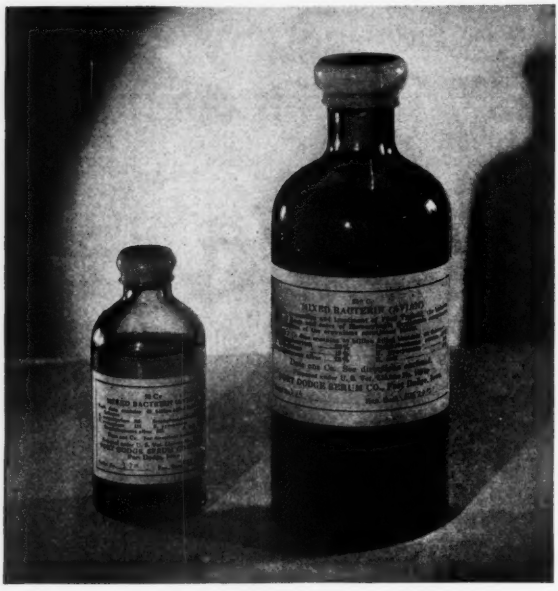

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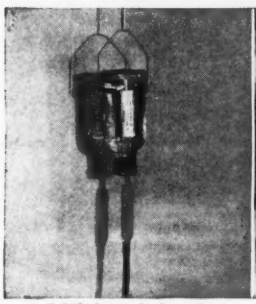
4 Slip holder over Saftiflask. This may be done at any time as bail is open to allow neck of flask to slip through.

5 To remove air from tube: 1—Open pinch clamp; 2—Raise needle; 3—Invert Saftiflask; 4—Slowly lower needle until fluid flows through; 5—Close pinch clamp. Note: Do not raise and lower needle more than once or dripmeter will fill with fluid.



6 Saftiflask may be hung from an irrigator stand, or tie bail to any convenient projection, or hang from nail on wall.

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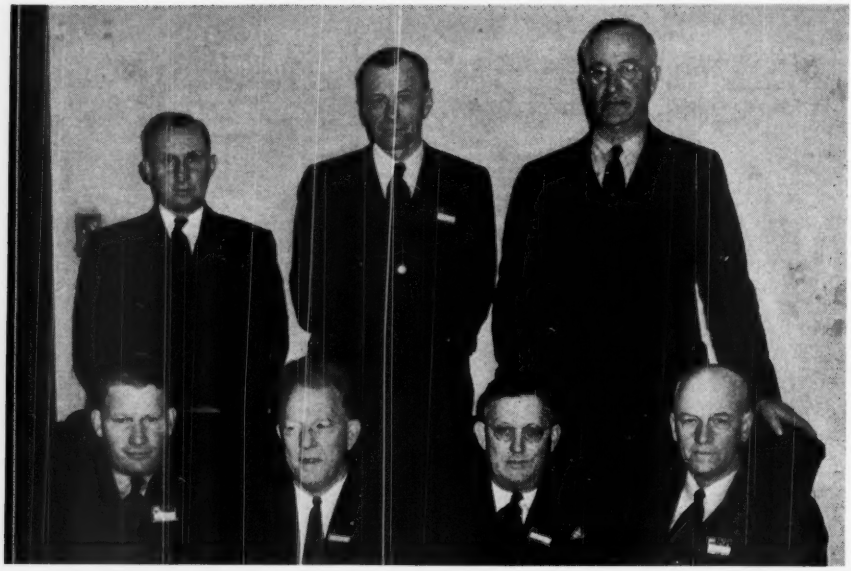

Officers of the Eastern Iowa Veterinary Association elected at the 26th annual convention. Left to right: Back row, A. R. Stephenson, Bennett; D. N. Voetberg, Traer; C. A. Stewart, Tripoli, trustees; seated, S. G. Paul, Clarence, treasurer; C. L. Crider, Elkader, vice-president; I. W. Moranville, Durant, president; H. E. Tyner, New London, secretary.

Eastern Iowa Veterinary Association Meeting

The 26th annual meeting of the Eastern Iowa Veterinary Association was held at Cedar Rapids October 17 and 18, 1939. Registered attendance included 219 veterinarians and 126 ladies, and there were many unregistered visitors.

Papers on the technical program included "Equine Encephalomyelitis," by H. E. Biester, Ames; "Moldy Corn Poisoning in Horses," by L. H. Schwarte, Ames; "The Physiology of Digestion," by E. A. Hewitt, Ames; "Bang's Disease in Cattle," by J. A. Barger, Des Moines; "Cattle Diseases," by R. R. Dykstra, Manhattan, Kans.; "Poultry Practice," by R. Fenstermacher, St. Paul, Minn.; "The Diseases of Farm Cats," by Wayne H. Riser, Des Moines; "Trichinosis in Swine," by E. S. Dickey, Ottumwa; "Studies on Swine Influenza," by Richard E. Shope, M. D., Rockefeller Institute, Princeton, N. J.; "The Effect of High Temperatures on Hog Cholera Virus and Anti-Hog Cholera Serum," by J. D. Ray, Omaha, Neb.; "Technique of Serum and Virus Administration," by Fred M. Maxfield, Gilman, and a radio broadcast by D. M. Campbell, Chicago.

(Continued on page XXII)

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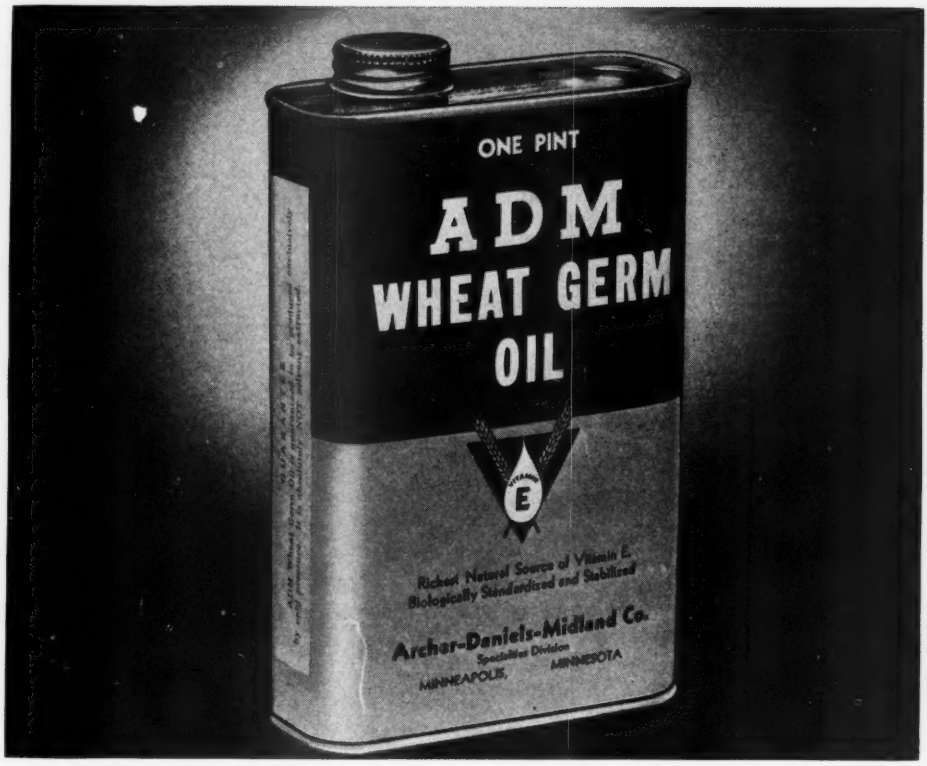

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MINNEAPOLIS, MINNESOTA

(Continued from page XVIII)

Ashe Lockhart was toastmaster at the banquet, which was attended by 257 persons. Brief talks were made by W. B. Holmes, Springfield, Ill., president of the Illinois V. M. A.; Earl R. Kennedy, Moline, Ill., president of the Mississippi Valley V. M. A.; and H. G. Dow, Fort Madison, Ia., president of the Mid-West Small Animal Association. Frank M. Wilson, Mechanicsville, spoke on the Iowa V. M. A., of which he is president, and Lieutenant Governor B. B. Hickenlooper of Cedar Rapids wound up the Banquet program with a patriotic address.

Featured at the closing Wednesday afternoon program were speeches by Hon. Mark G. Thornburg, Des Moines, State Secretary of Agriculture; Cassius Way, president of the A. V. M. A.; and H. D. Bergman, former A. V. M. A. president.

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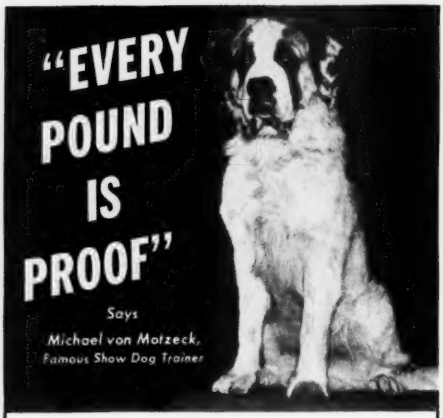

ST. ROLLO, pedigreed St. Bernard dog, whelped Feb. 25, 1938, is carefully checked by Michael von Motzeck, famous show dog trainer and operator of noted V & M Training and Conditioning Kennels.

St. Rollo, weighing 27 lbs. when received at the Morrell Kennels on April 28, 1938, has been fed exclusively since that time on the Morrell Feeding Plan,* using Red Heart Dog Biscuits as a base. "Today," says Mr. von Motzeck, "St. Rollo is in excellent show-type condition. His coat is splendid and possesses a beautiful luster. He has maintained proper weight during growth. Bone and teeth are in top-notch condition. St. Rollo is 29½" high and runs with a beautiful gait."

WHAT Red Heart Dog Biscuits have done for St. Rollo is not unusual—because they are made of 24 vital foods, many not found in any other food of this type. They are made of such wholesome ingredients as fresh meat, meat and bone scraps, marrow meat and bone, dry skimmed milk, fresh egg yolk, cereals, malt, and wheat germ. They are rich in essential vitamins, minerals, and iodine. Contain cod-liver oil and Fleischmann's *High Vitamin* Irradiated Yeast to assure an abundance of Sunshine Vitamin D, Anti-infective Vitamin A, and Anti-neuritic Vitamin B.

Try Red Heart Dog Biscuits as a base for *your* feeding plan. Each package contains 3 flavors—beef, fish, and cheese. You can get Red Heart Dog Biscuits heart-shaped or kibbled in bulk or package. If your dealer cannot supply you, write John Morrell & Co., General Offices, Ottumwa, Ia.

**Morrell Feeding Plan: 3 parts Red Heart Dog Biscuits, 8 parts Red Heart canned Dog Food, 6 parts water. Skim milk may be used for water, if desired.*

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Coming Meetings

The U. S. Live Stock Sanitary Association will hold its annual meeting December 6, 7 and 8 at the Morrison Hotel, Chicago.

The 25th annual meeting of the Oklahoma Veterinary Medical Association will be held at Oklahoma City, Okla., on January 8 and 9, 1940, with headquarters at the Skirvan Hotel.

January 16 and 17 are the dates for the annual meeting of the Veterinary Medical Association of New Jersey. The place: the Hotel Douglas, Newark.

The Kansas Veterinary Medical Association will hold its 1940 meeting January 17 and 18. The convention is to be held in Topeka, with headquarters at the Jayhawk Hotel.

The 1940 annual meeting of the Illinois State Veterinary Medical Association will be held at the Leland Hotel, Springfield, February 15 and 16.

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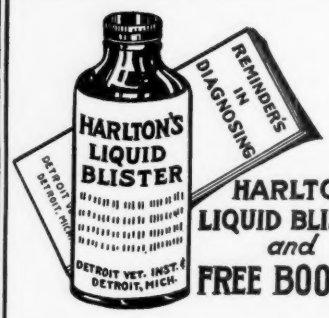
Cedar Valley Meeting

The Cedar Valley Veterinary Medical Association held its dinner-meeting at Waterloo, Sept. 11, with 55 veterinarians present. U. S. Inspector in Charge J. A. Barger of Des Moines talked on equine encephalomyelitis in Iowa in 1939; H. E. Biester, Iowa State College, Ames, on laboratory research work done on horse heads from suspected cases of encephalomyelitis sent to him from veterinarians in Iowa during the present season; and E. F. Waller, Iowa State College, Ames, on diseases of poultry.



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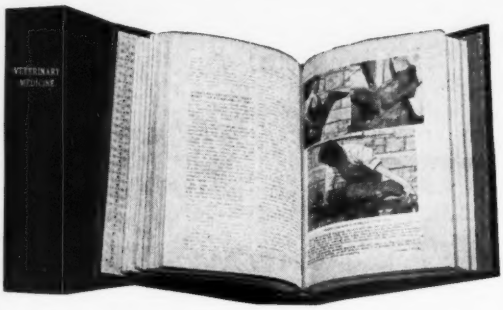

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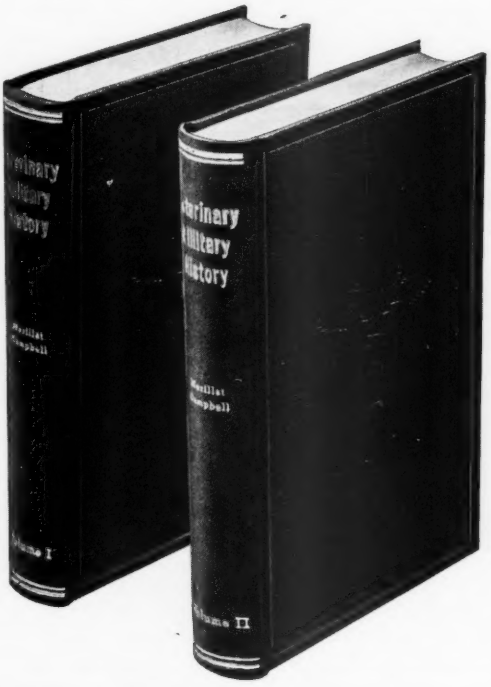

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Deaths of Veterinarians

I. P. Gilbert, 39, US '22, Courtland, Va., Aug. 11; Melancthon Hamilton, Oneonto, N. Y., COR '05, Otsego County Veterinarian 1920-25, Aug. 16; Andrew J. Ward, AVC '94, Greenwich, Conn., an authority on the breeding and training of saddle horses, Aug. 25; Frank W. Close, 55, WSC '07, Lewiston, Idaho, deputy state veterinarian, Sept. 2; Conrad John Johannes, 64, ONT '05, Saskatoon, Sask., veterinary surgeon in the health of animals branch of the Dominion department of agriculture, Sept. 4; Grove W. Loveland, 75, CHI '94, Torrington, Conn., for many years a member of the Connecticut State Board of Veterinary Medical Examiners, Milk Inspector of Torrington, former president of the Connecticut State Veterinary Medical Association, Sept. 18; Nicholas Rectenwald, 94, Pittsburgh, Pa., City Veterinarian of Pittsburgh 1903-15, in which capacity he purchased the first horses for Pittsburgh's Black Horse Troop, Sept. 18; Harrison A. Souther, 76, HAR '89, Boston, Mass., founder of the New England Dog Sled Club, Sept. 18; E. W. Widmer, 67, ONT, Hollisterville, Pa., Oct. 5; Frank T. McMahon, 77, Chicago, Ill., one of the oldest practicing veterinarians in Illinois, served for 48 years as chief veterinarian for the Chicago police mounted division, Oct. 18.

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Method of Proving Sires Devised for Beef Breeds

A simple method of "proving" beef sires similar to the plan now used in "proving" dairy sires has been developed by beef cattle specialists of the U. S. Department of Agriculture. By this method young bulls may be proved by their first calves and their value as sires determined.

The two plans are alike in that the worth of the sire in both cases depends on his progeny's record-of-performance. The beef sire is judged on his ability to transmit a capacity for efficient gains and high-quality meat just as the dairy sire is rated on his ability to transmit the capacity for high milk and butterfat production.

Beef-cattle breeders still depend largely on pedigrees and breed type in selecting herd sires, although differences in the ability of sires to transmit efficiency of gain and carcass quality to their progeny have long been recognized. Many sires of good type do not produce calves that gain efficiently.

The first essential in proving the beef sire is an equal opportunity for all of his calves on test—there should be a minimum of five steer calves. Because the dam of one calf may give more milk than another, the test is begun shortly after weaning time and the calves weaned at the same weight regardless of age. In the Department's tests all calves were started on the test at 500 pounds and slaughtered at 900 pounds. Neither the time spent in gaining the 400 pounds, nor the age of the calf when the test began are considered.

In the proposed method of proving beef sires the fattening ration may vary from region to region, using the most practical and available feed. Corn, barley, wheat or grain sorghums may make up the bulk of the record-of-performance ration, with a dry legume roughage that is more or less uniform in quality from year to year.

In developing the method 20 body measurements were made of each calf as they went on feed and again just before slaughter, but it was found that weight and height of the animal at the withers give a good correlation of all the measurements. From these two measurements, the grade of the steer may be determined.

How the record-of-performance tests may eliminate some sires with blue ribbon ancestry was shown at one of the Bureau of Animal Industry's stations. Here, calves from two bulls of prize winning ancestry were placed on a corn and alfalfa ration—the corn valued at 60 cents a bushel and the alfalfa hay at $20 a ton. The cost of the 400 pounds gain for calves of one sire was $31.66 per calf less than for the other sire.

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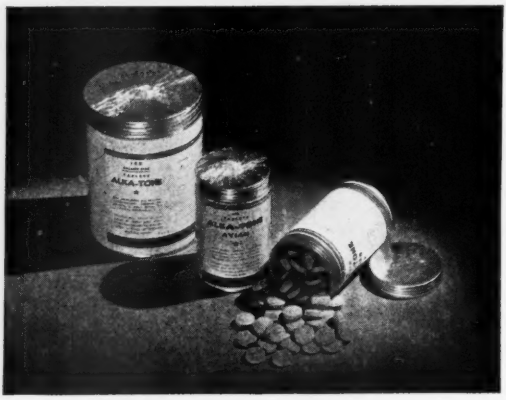

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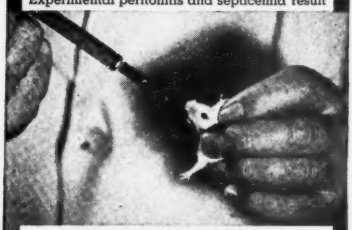

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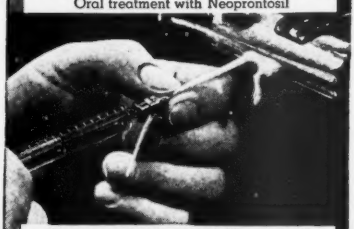
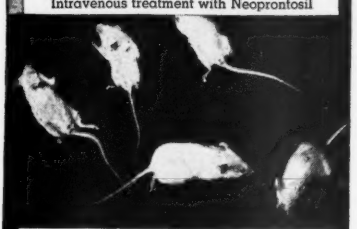


Intravenous treatment with Neoprontosil



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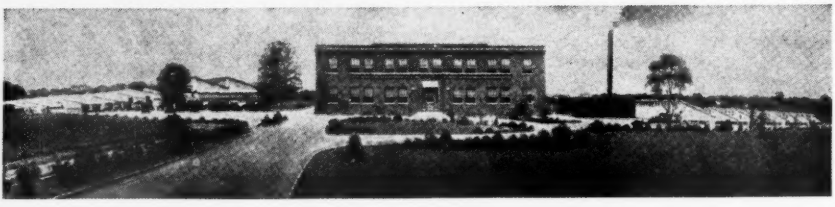

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